MOTOROLA

MOCOM® •70
FM Two-Way Radio

450-470 MHz (25 W)
470-512 MHz (10, 25, & 50 W)

Instruction Manual

68P81011E30-E

AVAILABLE BACKGROUND REFERENCE PUBLICATIONS

Three reference publications are available to provide background information needed to service some of the newer Motorola products more effectively. The information in these publications is not duplicated in our instruction manuals. To obtain your free copy, check the ones you want and return this self–mailer to us. (NOTE: One copy of each publication has already been distributed to Motorola Service Shops (MSS's) and field technical representatives (FTR's).

First Fold

First Fold

Check item desired:

☐ **Basic Logic Circuit Guide** 68P81105E88

Describes the basic logic circuits used in Motorola Communications digital equip–ment and the logic notational scheme used in our instruction manuals.

68P81028E93–C

☐ **"Digital Private–Line" Binary–Coded Squelch** 68P81106E83

Contains fundamentals of "Digital Private–Line" system operation, circuit operation and servicing techniques.

☐ **Safe Handling of CMOS Integrated Circuit Devices** 68P81106E84

Describes special handling techniques needed to prevent irrepairable damage from static charges encountered with normal handling of CMOS devices.

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Schaumburg, Illinois 60196

PLEASE STAPLE OR TAPE CLOSED BEFORE MAILING

"MOCOM • 70"

MOBILE FM TWO-WAY RADIO

450-470 MHz

25 W RF POWER

AND

470-512 MHz

10/25/50 W E.R.P.

MOTOROLA INC.
Communications Division

service publications
1301 E. Algonquin Road, Schaumburg, IL 60196

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Printed in USA

68P81011E30-E
6/8/76-PO

SPECIFICATIONS

GENERAL

MAXIMUM BATTERY DRAIN*	RECEIVE (STANDBY)	13.8 V dc 450 mA
	TRANSMIT	13.6 V dc 14 Amperes
*Drain figures for negative ground only, add .080 amp for positive ground operation.		
FREQUENCY RANGE		450-512 MHz
METERING		A single scale, 0-50 microampere meter with 20,000 ohms equivalent series resistance or Motorola portable test set can be used to measure all circuits essential to tuning and checking.
DIMENSIONS		4" high x 10-3/4" wide x 16-1/2" long
WEIGHT		Approximately 25 lbs (shipping weight including accessories: approximately 50 lbs).

TRANSMITTER

	450-470 MHz	470-512 MHz
RF POWER OUTPUT	25 watts	10/25/50 W E.R.P.
OUTPUT IMPEDANCE	50 ohms	
SPURIOUS & HARMONIC EMISSIONS	Spurious and harmonics more than 60 dB below carrier (per EIA spec RS-152B, Par. 4 and 5.	
FREQUENCY STABILITY	A temperature compensated quartz crystal maintains oscillator frequency within ±.0005% of reference frequency from -30°C to +60°C ambient (+25°C reference) and ±.0005% with a 20% primary voltage deviation.	
MODULATION	16F3: ±5 kHz for 100% at 1000 Hz @450-512 MHz	
AUDIO SENSITIVITY	0.1 volt ±3 dB for 3.0 kHz deviation at 1000 Hz	
FM NOISE	-70 dB below ±3.0 kHz deviation at 1000 Hz	
AUDIO RESPONSE	+1, -3 dB of 6 dB/octave pre-emphasis characteristic from 300 to 3000 Hz	
AUDIO DISTORTION	Less than 3% at 1000 Hz for ±3.0 kHz deviation	

RECEIVER

CHANNEL SPACING		25 kHz
SELECTIVITY (EIA SINAD)		-90 dB at 25 kHz, 450-470 MHz | -88 dB at 25 kHz, 470-512 MHz
EIA SINAD INTERMODULATION		-80 dB at 25 kHz (-75 dB with preamplifier)
EIA MODULATION ACCEPTANCE		±7.0 kHz minimum
SENSITIVITY	20 dB QUIETING	Less than 0.5 microvolt (less than 0.25 microvolt with preamplifier)
	EIA SINAD	Less than 0.35 microvolt (less than 0.18 microvolt with preamplifier)
FREQUENCY STABILITY		A temperature compensated quartz crystal maintains oscillator frequency within ±.0005% of reference frequency from -30°C to +60°C ambient (+25°C reference) and ±.0005% with a 20% primary voltage deviation.
SPURIOUS & IMAGE REJECTION		More than 100 dB
SQUELCH		Carrier squelch; noise compensated type, adjustable sensitivity, threshold sensitivity of 0.25 microvolt. "Private-Line" tone-coded squelch; also includes a tone-operated squelch circuit, adjustable sensitivity, threshold sensitivity of 0.25 microvolt. (Squelch threshold sensitivities are 0.15 microvolt with pre-amplifier)
AUDIO OUTPUT		5 watts to a 3.2-ohm load measured at the receiver output at less than 5% distortion @ 1000 Hz
AUDIO RESPONSE		+2, -8 dB of 6 dB/ octave de-emphasis characteristic from 300 to 3000 Hz

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

FCC LICENSE DESIGNATIONS

Frequency Range	Single Frequency	Multiple Frequency
450-470 MHz	CC4111	CC4112
470-494 MHz	CC4128-1	CC4129-1
494-512 MHz	CC4128-2	CC4129-2

FCC RECEIVER DESIGNATIONS

Frequency Capability	Standard	With Preamplifier
Single	RC0057	RC0058
Multiple (2-4 & T2-R1)	RC0059	RC0060
Eight	RC0061	Not Available

EPS-18788-O

SAFETY INFORMATION

The United States Department of Labor, through the provisions of the Occupational Safety and Health Act of 1970 (OHSA), has established an electromagnetic radiation safety standard which applies to any two-way mobile radio equipment. Normal use of this radio will result in exposures far below the OSHA limit. There are no reported incidents of physical damage resulting from the use of this type radio. However, the following precautions are recommended:

DO NOT operate the transmitter when someone outside the vehicle is within two feet of the mobile antenna.

DO NOT operate the transmitter near unshielded electrical blasting caps or in an explosive atmosphere.

EPS-18196-B

FOREWORD

1. SCOPE OF MANUAL

This manual is intended for use by experienced technicians familiar with similar types of equipment. It contains all service information required for the equipment described and is current as of the printing date. Changes which occur after the printing date are incorporated by Instruction Manual Revisions (SMR). These SMR's are added to the manuals as the engineering changes are incorporated into the equipment.

2. MODEL AND KIT IDENTIFICATION

Motorola equipments are specifically identified by an overall model number on the nameplate. In most cases, assemblies and kits which make up the equipment also have kit model numbers stamped on them. When a production or engineering change is incorporated, revision suffix numerals are added to the affected kit model number. For example, a TLN4448A becomes a TLN4448A-1 with the first revision, TLN4448A-2 with the second revision, etc.

As diagrams are updated, information about the change is incorporated into a revision column. This revision column appears in the manual next to the parts list or, in some cases, on the diagram. It lists the reference number, part number, and description of the parts removed or replaced when the suffix number changed. With this information, the technician can find the information for the current version, and any previous version, of the equipment covered by the manual.

3. SERVICE

Motorola's National Service Organization offers one of the finest nation-wide installation and maintenance programs available to communication equipment users. This organization includes approximately 800 authorized Motorola Service Stations (MSS) located throughout the United States, each manned by one or more trained, FCC licensed technicians.

These MSS's are independently owned and operated and were selected by Motorola to service its customers. Motorola maintenance is available on either a time and material basis or on a periodic fixed-fee type arrangement.

The administrative staff of this organization consists of national, area and district service managers and district service representatives, all of whom are Motorola employees with the objective to improve the service to our customers.

Should you wish to purchase a service contract for your Motorola equipment, contact your Motorola Service Representative, or write to:

National Service Manager
Motorola Communications Division
1301 E. Algonquin Road
Schaumburg, Illinois 60196

4. REPLACEMENT PARTS ORDERING

Motorola maintains a number of parts offices strategically-located throughout the United States. These facilities are staffed to process parts orders, identify part numbers, and otherwise assist in the maintenance and repair of Motorola Communications Division products.

Orders for all parts except crystals, channel elements, and "Vibrasender"® and "Vibrasponder"® resonant reeds should be sent to the nearest area parts center. Orders for instruction manuals should also be sent to the area parts center.

When ordering replacement parts or equipment information, the complete identification number should be included. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part, and sufficient description of the desired component to identify it.

Orders for crystals, channel elements, active filters, code plugs, and reeds should be sent directly to the factory address listed on the following page. Crystal and channel element orders should specify the crystal or channel element type number, crystal and carrier frequency, and the chassis model number in which the part is used.

Orders for active filters, code plugs, "Vibrasender" and "Vibrasponder" resonant reeds should specify type number and frequency, and should identify the owner/operator of the communications system in which these items are to be used.

68P81025E81-F

5. ADDRESSES

5.1 GENERAL OFFICES

MOTOROLA, INC.
Communications Division Parts Dept.
1313 E. Algonquin Rd.,
Schaumburg, Illinois 60172
Phone: 312-397-1000
Executive Offices: 1301 E. Algonquin Rd.,
Schaumburg, Illinois 60172

5.2 U.S. ORDERS

WESTERN AREA PARTS
1170 Chess Drive, Foster City,
San Mateo, California 94404
Phone: 415-349-3111
TWX: 910-375-3877

MIDWEST AREA PARTS
10 W. North Ave.,
Lombard, Ill. 60148
Phone: 312-620-3000
TWX: 910-693-1592

MID–ATLANTIC AREA PARTS
6701 Elkridge Landing Road,
Linthicum, Maryland 21090
Phone: 301-796-8600

EAST CENTRAL AREA PARTS
12995 Snow Road,
Parma, Ohio 44130
Phone: 216-267-2210
TWX: 810-421-8845

EASTERN AREA PARTS
85 Harristown Road,
Glen Rock, New Jersey 07452
Phone: 201-447-4000
TWX: 710-988-5602

PACIFIC SOUTHWESTERN AREA PARTS
2333 Utah Avenue,
El Segundo, California 90245
Phone: 213-644-1101
TWX: 910-348-6278

SOUTHWESTERN AREA PARTS
3320 Belt Line Road,
Dallas, Texas 75234
Phone: 214-241-2151
TWX: 910-860-5505

SOUTHEASTERN AREA PARTS
5096 Panola
Industrial Blvd.
Decatur, Georgia 30032
Phone: 404-981-9800
TWX: 810-751-8300

5.3 CANADIAN ORDERS

CANADIAN MOTOROLA ELECTRONICS COMPANY
Parts Department
3125 Steeles Avenue,
East Willowdale, Ontario
Phone: 516-499-1441
TWX: 610-492-2713
Telex: 02-29944LD

5.4 ALL COUNTERIES EXCEPT U.S. AND CANADA

MOTOROLA, INC. OR MOTOROLA AMERICAS, INC.
International Parts
1313 E. Algonquin Road
Schaumburg, Illinois 60172 U.S.A.
Phone: 312-397-1000
TWX: 910-693-1592 or 1599
Telex: 722443 or 722424
Cable: MOTOL

5.5 FACTORY ADDRESS FOR CRYSTAL, CHANNEL ELEMENT, ACTIVE FILTER, CODE PLUGS AND RESONANT REED ORDERS

AIR MAIL ORDERS
Motorola, Inc.
Component Products Sales & Service
P.O. Box 66191
O'Hare International Airport
Chicago, Ill. 60666

REGULAR MAIL ORDERS AND CORRESPONDENCE
Motorola, Inc.
Component Products Sales & Service
2553 Edgington Street
Franklin Park, Illinois 60131

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MOTOROLA

MODEL CHART

FOR

450-470 MHz

"MOCOM · 70" RADIO SETS

WITH ACCESSORIES

VERSION 2

CODE:

[X] = ONE ITEM SUPPLIED

[/] = ONE ITEM SUPPLIED DEPENDENT ON FREQUENCY RANGE.

[*] - OPTIONAL ANTENNA

*SEE BASIC RADIO SET MODEL CHART FOR RADIO SET COMPLEMENT

ITEM	DESCRIPTION	PACKAGE MODEL	D44BBN-1100CK	D44BBN-1130CK	D44BBN-1190CK	D44BBN-3100CK	D44BBN-3130CK	D44BBN-3190CK	T44BBN-1100CK	T44BBN-1130CK	T44BBN-1190CK	T44BBN-3100CK	T44BBN-3130CK	T44BBN-3190CK	T44BBN-1100DK	T44BBN-1130DK	T44BBN-1190DK	T44BBN-3100DK	T44BBN-3130DK	T44BBN-3190DK
	DESCRIPTION	BASIC RADIO SET*	DASH MOUNT RADIO SET CARRIER SQUELCH						TRUNK MOUNT RADIO SET CARRIER SQUELCH											
			U44BBN-1100A	U44BBN-1130A	U44BBN-1190A	U44BBN-3100A	U44BBN-3130A	U44BBN-3190A	T44BBN-1100A	T44BBN-1130A	T44BBN-1190A	T44BBN-3100A	T44BBN-3130A	T44BBN-3190A	T44BBN-1100A	T44BBN-1130A	T44BBN-1190A	T44BBN-3100A	T44BBN-3130A	T44BBN-3190A
			1-FREQUENCY	2-FREQUENCY	"PRIVATE-LINE" TONE-CODED SQUELCH MULTI-FREQUENCY	1-FREQUENCY	2-FREQUENCY	"PRIVATE-LINE" TONE-CODED SQUELCH MULTI-FREQUENCY	1-FREQUENCY	2-FREQUENCY	"PRIVATE-LINE" TONE-CODED SQUELCH MULTI-FREQUENCY	1-FREQUENCY	2-FREQUENCY	"PRIVATE-LINE" TONE-CODED SQUELCH MULTI-FREQUENCY	1-FREQUENCY	2-FREQUENCY	"PRIVATE-LINE" TONE-CODED SQUELCH MULTI-FREQUENCY	1-FREQUENCY	2-FREQUENCY	"PRIVATE-LINE" TONE-CODED SQUELCH MULTI-FREQUENCY
TLN6246A	"PRIVATE-LINE" HANG-UP BOX					X	X	X				X	X	X				X	X	X
TCN6141BE	DUAL-PURPOSE CONTROL HEAD, 1-FREQ. WITH DIMMER (DASH MOUNT)		X			X														
TLN4208A	INSTALLATION KIT, DASH MOUNT		X	X	X	X	X	X												
TMN6013A	MICROPHONE		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
TSN6000A	SPEAKER		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
TCN6141BF	DUAL-PURPOSE CONTROL HEAD, 2-FREQ. WITH DIMMER (DASH MOUNT)			X			X													
TCN6141BJ	DUAL-PURPOSE CONTROL HEAD, 4-FREQ. WITH DIMMER (DASH MOUNT)				X			X												
TCN6026BE	DUAL-PURPOSE CONTROL HEAD, 1-FREQ. (TRUNK MOUNT)								X			X								
TKN6055A	CABLE KIT, TRUNK MOUNT, SINGLE FREQ.								X			X			X			X		
TLN6042A	INSTALLATION KIT, TRUNK MOUNT								X	X	X	X	X	X	X	X	X	X	X	X
TCN6026BF	DUAL-PURPOSE CONTROL HEAD, 2-FREQ. (TRUNK MOUNT)									X			X							
TKN6056A	CABLE KIT, TRUNK MOUNT, MULTI-FREQ.									X	X		X	X		X	X		X	X
TCN6026BJ	DUAL-PURPOSE CONTROL HEAD, 4-FREQ. (TRUNK MOUNT)										X			X						
TCN6136BF	DUAL-PURPOSE CONTROL HEAD, C2-R1, WITH DIMMER (TRUNK MOUNT)																			
TLN4445A	"PRIVATE-LINE" HANG-UP SWITCH BOX											X	X	X				X	X	X
TAE6052A	ANTENNA UNITY GAIN (450-470 MHz)		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
TAE6062A	ANTENNA (450-470 MHz) 5 dB GAIN		/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
TCN6098CE	DUAL-PURPOSE CONTROL HEAD, 1-FREQ. WITH DIMMER (TRUNK MOUNT)															X			X	
TCN6098CF	DUAL-PURPOSE CONTROL HEAD, 2-FREQ. WITH DIMMER (TRUNK MOUNT)																X			X
TCN6098CJ	DUAL-PURPOSE CONTROL HEAD, 4-FREQ. WITH DIMMER (TRUNK MOUNT)																	X		

EPS-20794-O

MOTOROLA

MODEL CHART

FOR

450-512 MHz

MOCOM - 70 RADIO SETS

DASH-MOUNT PACKAGE MODELS

X - ONE ITEM SUPPLIED

- SEE BASIC RADIO SET CHART FOR RADIO SET COMPLEMENT.

▨ - ONE ITEM SUPPLIED DEPENDENT UPON FREQUENCY RANGE.

ITEM	DESCRIPTION	MODEL	RADIO SET	DESCRIPTION	RF POWER
[illegible]	CONTROL HEAD (1-FREQ.) DUAL-PURPOSE W/DIMMER	D24BBA-1000BK	D24BBA-1000AA	1-FREQUENCY TONE-COD D SQUELCH MODELS	[illegible]
TCN6141BF	CONTROL HEAD (2-FREQ.) DUAL-PURPOSE W/DIMMER	[illegible]	[illegible]	[illegible]	[illegible]
TCN6141BJ	CONTROL HEAD (4-FREQ.) DUAL-PURPOSE W/DIMMER	D24BBA-1900BK	D24BBA-1900AA	[illegible]	[illegible]
TAE6062A	ANTENNA (450-470 MHz) 5 dB GAIN	[illegible]	[illegible]	[illegible]	[illegible]
TAE [illegible]	ANTENNA (470-494 MHz) 5 dB GAIN	[illegible]	[illegible]	[illegible]	[illegible]
TAE6095B	ANTENNA (494-512 MHz) 5 dB GAIN	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	INSTALLATION KIT	[illegible]	[illegible]	[illegible]	[illegible]
TMN [illegible]	MICROPHONE	[illegible]	[illegible]	[illegible]	[illegible]
TSN6000A	SPEAKER	[illegible]	[illegible]	[illegible]	[illegible]
		D24BBA-3000BK	D24BBA-3000AA	1-FREQUENCY	
		[illegible]	[illegible]	[illegible]	
		D34BBA-3000BK	D34BBA-3000AA	2-FREQUENCY	
		D34BBA-3300BK	D34BBA-3300AA	2-FREQUENCY	
		D34BBA-3900BK	D34BBA-3900AA	4-FREQUENCY	

EPS-[illegible]

MOTOROLA

MODEL CHART

FOR

450-512 MHz

"MOCOM · 70" RADIO SETS

TRUNK-MOUNT PACKAGE MODELS

CODE:

[X] = ONE ITEM SUPPLIED

( ) - SEE BASIC RADIO SET CHART FOR RADIO SET COMPLEMENT

[/] - ONE ITEM SUPPLIED DEPENDENT UPON FREQUENCY RANGE.

ITEM	DESCRIPTION
TCN6098CE	CONTROL HEAD (1-FREQ.) DUAL-PURPOSE W/DIMMER
TCN6136BF	CONTROL HEAD (C2-R1) DUAL-PURPOSE W/DIMMER
TCN6098CF	CONTROL HEAD (2-FREQ.) DUAL-PURPOSE W/DIMMER
TCN6098CJ	CONTROL HEAD (4-FREQ.) DUAL-PURPOSE W/DIMMER
TKN6055A	CABLE KIT (17-FT) SINGLE-FREQ.
TKN6056A	CABLE KIT (17-FT) MULTI-FREQ.
TAE6094B	ANTENNA (470-494 MHz) 5 dB GAIN
TAE6095B	ANTENNA (494-512 MHz) 5 dB GAIN
TAE6062A	ANTENNA (450-470 MHz) 5 dB GAIN
TLN6042A	INSTALLATION KIT
TMN6013A	MICROPHONE
TSN6000A	SPEAKER

MODEL NUMBER	BASIC RADIO SET(*)	DESCRIPTION	RF POWER
		CARRIER SQUELCH MODELS	
T24BBA-1000AK	U24BBA-1000AA	1-FREQUENCY	16 W
T24BBA-1300AK	U24BBA-1300AA	2-FREQUENCY	16 W
T24BBA-1900AK	U24BBA-1900AA	4-FREQUENCY	16 W
T34BBA-1000AK	U34BBA-1000AA	1-FREQUENCY	22/25 W
T34BBA-1300AK	U34BBA-1300AA	2-FREQUENCY	22/25 W
T34BBA-1900AK	U34BBA-1900AA	4-FREQUENCY	22/25 W
		"PRIVATE-LINE" TONE-CODED SQUELCH MODELS	
T24BBA-3000AK	U24BBA-3000AA	1-FREQUENCY	16 W
T24BBA-3300AK	U24BBA-3300AA	2-FREQUENCY	16 W
T24BBA-3900AK	U24BBA-3900AA	4-FREQUENCY	16 W
T34BBA-3000AK	U34BBA-3000AA	1-FREQUENCY	22/25 W
T34BBA-3300AK	U34BBA-3300AA	2-FREQUENCY	22/25 W
T34BBA-3900AK	U34BBA-3900AA	4-FREQUENCY	22/25 W

EPS-20796-O

MOTOROLA

MODEL CHART

FOR

450-512 MHz 16 W AND 25 W RF POWER

"MOCOM® -70" MOBILE FM TWO-WAY RADIO

"DIGITAL PRIVATE-LINE" CODED SQUELCH

PACKAGE RADIO SET MODELS

("BK" SERIES)

CODE:

[X] - ONE ITEM SUPPLIED

* - REFER TO THE BASIC RADIO SET MODEL CHART FOR MODEL COMPLEMENT

[/] = ONE ITEM SUPPLIED DEPENDENT UPON FREQUENCY RANGE.

ITEM	DESCRIPTION	TYPE OF MOUNT
TCN6141BE	CONTROL HEAD (SINGLE-FREQUENCY)	DASH-MOUNT
TCN6141BF	CONTROL HEAD (TWO-FREQUENCY)	DASH-MOUNT
TCN6141BJ	CONTROL HEAD (FOUR-FREQUENCY)	DASH-MOUNT
TCN6098CE	CONTROL HEAD (SINGLE-FREQUENCY)	TRUNK-MOUNT
TCN6098CF	CONTROL HEAD (TWO-FREQUENCY)	TRUNK-MOUNT
TCN6098CJ	CONTROL HEAD (FOUR-FREQUENCY)	TRUNK-MOUNT
TCN6136BF	CONTROL HEAD (TWO-FREQUENCY)	TRUNK-MOUNT
TKN6055A	CONTROL CABLE (SINGLE-FREQUENCY)	TRUNK-MOUNT
TKN6056A	CONTROL CABLE (MULTI-FREQUENCY)	TRUNK-MOUNT
TMN6013A	MICROPHONE	
TLN4445A	MICROPHONE HANG-UP BOX	
TSN6000A	SPEAKER	
TLN4208A	INSTALLATION KIT	DASH-MOUNT
TLN6042A	INSTALLATION KIT	TRUNK-MOUNT
TAE6094B	ANTENNA (470-494 MHz) 5 dB GAIN	
TAE6095B	ANTENNA (494-512 MHz) 5 dB GAIN	
TAE6062A	ANTENNA, GAIN (450-470 MHz)	

MODEL NUMBER	BASIC RADIO MODELS *	TRANSMITTER FREQUENCIES	RECEIVER FREQUENCIES	TRANSMITTER RF POWER
DASH-MOUNT RADIO MODELS				
D24BBA-6000BK	U24BBA-6000AA	1	1	16 W
D24BBA-6300BK	U24BBA-6300AA	2	2	16 W
D24BBA-6900BK	U24BBA-6900AA	4	4	16 W
D34BBA-6000BK	U34BBA-6000AA	1	1	25 W
D34BBA-6300BK	U34BBA-6300AA	2	2	25 W
D34BBA-6900BK	U34BBA-6900AA	4	4	25 W
TRUNK-MOUNT RADIO MODELS				
T24BBA-6000BK	T24BBA-6000AA	1	1	16 W
T24BBA-6300BK	T24BBA-6300AA	2	2	16 W
T24BBA-6900BK	T24BBA-6900AA	4	4	16 W
T34BBA-6000BK	T34BBA-6000AA	1	1	25 W
T34BBA-6300BK	T34BBA-6300AA	2	2	25 W
T34BBA-6900BK	T34BBA-6900AA	4	4	25 W

EPS-20797-O

MOTOROLA

MODEL CHART

FOR

470-512 MHz

"MOCOM · 70" RADIO SETS

WITH ACCESSORIES

CODE:

- [ ] SEE BASIC RADIO SET MODEL CHART FOR RADIO SET COMPLEMENT
- [X] = ONE ITEM SUPPLIED
- [O] - ONE ITEM SUPPLIED DEPENDENT UPON FREQUENCY RANGE.
- [▨] : OPTIONAL ANTENNA.. THE ANTENNA USED WITH THE RADIO SET DETERMINES EFFECTIVE RADIATED POWER (ERP) AS FOLLOWS:

ANTENNA	RADIO SET RF POWER	ERP
TAE6054A (Unity Gain)	16 W	10 W
TAE6074A/75A (3-1/2 dB Gain)	16 W	25 W

ITEM	DESCRIPTION
TCN6141E	CONTROL HEAD, DUAL PURPOSE, 1-FREQ. WITH DIMMER (DASH MOUNT)
TCN6141F	CONTROL HEAD, DUAL PURPOSE, 2-FREQ. WITH DIMMER (DASH MOUNT)
TCN6141J	CONTROL HEAD, DUAL PURPOSE 4-FREQ. WITH DIMMER (DASH MOUNT)
TCN6026E	CONTROL HEAD, DUAL PURPOSE, 1-FREQ. (TRUNK MOUNT)
TCN6026F	CONTROL HEAD, DUAL PURPOSE, 2-FREQ. (TRUNK MOUNT)
TCN6026J	CONTROL HEAD, DUAL PURPOSE, 4-FREQ. (TRUNK MOUNT)
TCN6136E	CONTROL HEAD, DUAL PURPOSE, C2-R1, WITH DIMMER (TRUNK MOUNT)
TKN6056A	CABLE KIT, SINGLE-FREQ. (TRUNK MOUNT)
TKN6056A	CABLE KIT, MULTI-FREQ. (TRUNK MOUNT)
TMN6011A	MICROPHONE
TSN6000A	SPEAKER
TLN4445A	HANG-UP SWITCH BOX "PRIVATE-LINE"
TAE6054A	ANTENNA, 470-512 MHz (UNITY GAIN)
TAE6021B	ANTENNA, 470-494 MHz (5 dB GAIN)
TAE6095E	ANTENNA, 494-512 MHz (5 dB GAIN)
TAE6074A	ANTENNA, 470-494 MHz (3-1/2 dB GAIN)
TAE6075A	ANTENNA, 494-512 MHz (3-1/2 dB GAIN)
TLN4408A	INSTALLATION KIT (DASH MOUNT)
TLN6042A	INSTALLATION KIT (TRUNK MOUNT)
TCN6098CE	CONTROL HEAD, DUAL-PURPOSE, 1-FREQ. WITH DIMMER (TRUNK MOUNT)
TCN6098CF	CONTROL HEAD, DUAL-PURPOSE, 2-FREQ. WITH DIMMER (TRUNK MOUNT)
TCN6098CJ	CONTROL HEAD, DUAL-PURPOSE, 4-FREQ. WITH DIMMER (TRUNK MOUNT)

PACKAGE MODEL	BASIC RADIO SET*	RF POWER	TRANSMITTER FREQUENCIES	RECEIVER FREQUENCIES
DASH MOUNT RADIO SET				
CARRIER SQUELCH				
D24BCA-1000BK	U24BCA-1000AA	16 W	1	1
D24BCA-1300BK	U24BCA-1300AA	16 W	2	2
D24BCA-1900BK	U24BCA-1900AA	16 W	4	4
D34BCA-1000BK	U34BCA-1000AA	22 W	1	1
D34BCA-1300BK	U34BCA-1300AA	22 W	2	2
D34BCA-1900BK	U34BCA-1900AA	22 W	4	4
"PRIVATE-LINE" TONE-CODED SQUELCH				
D24BCA-3000BK	U24BCA-3000AA	16 W	1	1
D24BCA-3300BK	U24BCA-3300AA	16 W	2	2
D24BCA-3900BK	U24BCA-3900AA	16 W	4	4
D34BCA-3000BK	U34BCA-3000AA	22 W	1	1
D34BCA-3300BK	U34BCA-3300AA	22 W	2	2
D34BCA-3900BK	U34BCA-3900AA	22 W	4	4
TRUNK MOUNT RADIO SET				
CARRIER SQUELCH				
T24BCA-1000BK	U24BCA-1000AA	16 W	1	1
T24BCA-1300BK	U24BCA-1300AA	16 W	2	2
T24BCA-1900BK	U24BCA-1900AA	16 W	4	4
T34BCA-1000BK	U34BCA-1000AA	22 W	1	1
T34BCA-1300BK	U34BCA-1300AA	22 W	2	2
T34BCA-1900BK	U34BCA-1900AA	22 W	4	4
T24BCA-1000CK	U24BCA-1000AA	16 W	1	1
T24BCA-1300CK	U24BCA-1300AA	16 W	2	2
T24BCA-1900CK	U24BCA-1900AA	16 W	4	4
T34BCA-1000CK	U34BCA-1000AA	22 W	1	1
T34BCA-1300CK	U34BCA-1300AA	22 W	2	2
T34BCA-1900CK	U34BCA-1900AA	22 W	4	4
"PRIVATE-LINE" TONE-CODED SQUELCH				
T24BCA-3000BK	U24BCA-3000AA	16 W	1	1
T24BCA-3300BK	U24BCA-3300AA	16 W	2	2
T24BCA-3900BK	U24BCA-3900AA	16 W	4	4
T34BCA-3000BK	U34BCA-3000AA	22 W	1	1
T34BCA-3300BK	U34BCA-3300AA	22 W	2	2
T34BCA-3900BK	U34BCA-3900AA	22 W	4	4
T24BCA-3000CK	U24BCA-3000AA	16 W	1	1
T24BCA-3900CK	U24BCA-3900AA	16 W	4	4
T34BCA-3300CK	U34BCA-3300AA	22 W	2	2
T34BCA-3900CK	U34BCA-3900AA	22 W	4	4

EPS-20798-O

MOTOROLA

MODEL CHART

FOR

450-512 MHz 15 W AND 25 W RF POWER

"MOCOM® •70" MOBILE FM TWO-WAY RADIO

"DIGITAL PRIVATE-LINE" CODED SQUELCH

BASIC RADIO MODELS

(LATER VERSION)

CODE:

- [X] = ONE ITEM SUPPLIED
- [/] = ONE ITEM SUPPLIED DEPENDENT UPON FREQUENCY RANGE
- [0] = ONE ITEM SUPPLIED FOR FIVE OR LESS RADIO SETS
- [2] = NUMBER INDICATES QUANTITY SUPPLIED

ITEM	DESCRIPTION	MODEL NUMBER U24BBA-6000AA	U24BBA-6300AA	U24BBA-6900AA	U24BBA-6100AA	U34BBA-6000AA	U34BBA-6300AA	U34BBA-6900AA	U34BBA-6100AA
	TRANSMITTER RF POWER	15 W	15 W	15 W	15 W	25 W	25 W	25 W	25 W
	RECEIVER FREQUENCIES	1	2	4	1	1	2	4	1
	TRANSMITTER FREQUENCIES	1	2	4	2	1	2	4	2
TLE6592B	CIRCUIT BOARD (SINGLE-FREQUENCY) 450-470 MHz								
TLE6593B	CIRCUIT BOARD (SINGLE-FREQUENCY) 470-494 MHz	/				/			
TLE6594B	CIRCUIT BOARD (SINGLE-FREQUENCY) 494-512 MHz								
TLE6612B	CIRCUIT BOARD (MULTI-FREQUENCY) 450-470 MHz								
TLE6613B	CIRCUIT BOARD (MULTI-FREQUENCY) 470-494 MHz		/	/			/	/	
TLE6614B	CIRCUIT BOARD (MULTI-FREQUENCY) 494-512 MHz								
TFE6153A	HARMONIC FILTER (450-470 MHz)								
TFE6154A	HARMONIC FILTER (470-494 MHz)	/	/	/	/	/	/	/	/
TFE6155A	HARMONIC FILTER (494-512 MHz)								
TLE1552A	POWER AMPLIFIER (450-470 MHz)								
TLE1553A	POWER AMPLIFIER (470-494 MHz)	/	/	/	/	/	/	/	/
TLE1554A	POWER AMPLIFIER (494-512 MHz)								
TLE6603A	INJECTION TRIPLER (450-470 MHz)								
TLE6604A	INJECTION TRIPLER (470-494 MHz)	/	/	/	/	/	/	/	/
TLE6605A	INJECTION TRIPLER (494-512 MHz)								
TLE6573A	VARACTOR MULTIPLIER (450-470 MHz)								
TLE6574A	VARACTOR MULTIPLIER (470-494 MHz)	/	/	/	/	/	/	/	/
TLE6575A	VARACTOR MULTIPLIER (494-512 MHz)								
TLE6583A	RECEIVER RF DECK (450-470 MHz)								
TLE6584A	RECEIVER RF DECK (470-494 MHz)	/	/	/	/	/	/	/	/
TLE6585A	RECEIVER RF DECK (494-512 MHz)								
TFN1000AS	RECEIVER FILTER	X	X	X	X	X	X	X	X
TLN4473A	CIRCUIT PROTECTION KIT	X	X	X	X	X	X	X	X
TLN4476A	ANTENNA SWITCH KIT	X	X	X	X	X	X	X	X
TLN4836A	CHASSIS HARDWARE KIT	X	X	X	X	X	X	X	X
TKN6491B	INTERCABLE KIT (SINGLE-FREQUENCY)	X				X			
TKN6492B	INTERCABLE KIT (MULTI-FREQUENCY)		X	X	X		X	X	X
TLN8427A	NEGATIVE GROUND PLUG KIT	X	X	X	X	X	X	X	X
TLN5817A	DIGITAL "PRIVATE-LINE" ENCODER-DECODER	X	X	X	X	X	X	X	X
TRN6005A	CODE PLUG	X	X	X	X	X	X	X	X
RXN1002A	CHANNEL RESONATOR, TRANSMITTER	X	2	4	2	X	2	4	2
K1018A	CHANNEL RESONATOR, RECEIVER	X	2	4	X	X	2	4	X
THN6113A	FRONT PANEL & HOUSING KIT	X	X	X	X	X	X	X	X
TLN4474A	TUNING TOOL KIT	0	0	0	0	0	0	0	0

EPS-18015-A

MOTOROLA

MODEL CHART

FOR

450-512 MHz 15 W AND 25 W RF POWER

"MOCOM® •70" MOBILE•FM TWO-WAY RADIO

"DIGITAL PRIVATE-LINE" CODED SQUELCH

PACKAGE RADIO SET MODELS

(LATER VERSION)

CODE:

[X] ONE ITEM SUPPLIED

* · REFER TO THE BASIC RADIO SET MODEL CHART FOR MODEL COMPLEMENT

ITEM	DESCRIPTION	TYPE OF MOUNT	MODEL NUMBER	BASIC RADIO MODELS *	TRANSMITTER FREQUENCIES	RECEIVER FREQUENCIES	TRANSMITTER RF POWER
			DASH-MOUNT RADIO MODELS				
TCN6141BE	CONTROL HEAD (SINGLE-FREQUENCY)	DASH-MOUNT	D24BBA-6000AK	U24BBA-6000AA	1	1	15 W
TCN6141BF	CONTROL HEAD (TWO-FREQUENCY)	DASH-MOUNT	D24BBA-6300AK	U24BBA-6300AA	2	2	15 W
TCN6141BJ	CONTROL HEAD (FOUR-FREQUENCY)	DASH-MOUNT	D24BBA-6900AK	U24BBA-6900AA	4	4	15 W
TCN6098CE	CONTROL HEAD (SINGLE-FREQUENCY)	TRUNK-MOUNT	D34BBA-6000AK	U34BBA-6000AA	1	1	25 W
TCN6098CF	CONTROL HEAD (TWO-FREQUENCY)	TRUNK-MOUNT	D34BBA-6300AK	U34BBA-6300AA	2	2	25 W
TCN6098CJ	CONTROL HEAD (FOUR-FREQUENCY)	TRUNK-MOUNT	D34BBA-6900AK	U34BBA-6900AA	4	4	25 W
TCN6136BF	CONTROL HEAD (TWO-FREQUENCY)	TRUNK-MOUNT					
TKN6055A	CONTROL CABLE (SINGLE-FREQUENCY)	TRUNK-MOUNT					
TKN6056A	CONTROL CABLE (MULTI-FREQUENCY)	TRUNK-MOUNT					
TMN6013A	MICROPHONE						
TLN4445A	MICROPHONE HANG-UP BOX						
TSN6000A	SPEAKER						
TLN4208A	INSTALLATION KIT	DASH-MOUNT					
TLN6042A	INSTALLATION KIT	TRUNK-MOUNT					
TAE6052A	ANTENNA (450-470 MHz)						
TAE6054A	ANTENNA (470-512 MHz)						
TAE6062A	ANTENNA, GAIN (450-470 MHz)						
			TRUNK-MOUNT RADIO MODELS				
			T24BBA-6000AK	U24BBA-6000AA	1	1	15 W
			T24BBA-6100AK	T24BBA-6100AA	2	1	15 W
			T24BBA-6300AK	U24BBA-6300AA	2	2	15 W
			T24BBA-6900AK	U24BBA-6900AA	4	4	15 W
			T34BBA-6000AK	T34BBA-6000AA	1	1	35 W
			T34BBA-6100AK	T34BBA-6100AA	2	1	25 W
			T34BBA-6300AK	U34BBA-6300AA	2	2	25 W
			T34BBA-6900AK	U34BBA-6900AA	4	4	25 W

EPS-18016-A

MOTOROLA

MODEL CHART

FOR

450-512 MHz

14 W AND 22/25 W RF POWER

"MOCOM • 70" BASIC RADIO SETS

CODE:

[X] = ONE ITEM SUPPLIED

[⧄] = ONE ITEM SUPPLIED DEPENDENT ON FREQUENCY RANGE

[-] = ONE ITEM SUPPLIED FOR FIVE OR LESS RADIO SETS

[2] - NUMBER INDICATES QUANTITY SUPPLIED

= SEE UNIFIED CHASSIS CHART FOR KIT COMPLEMENT.

ITEM	DESCRIPTION	MODEL NUMBER	RF POWER	TRANSMITTER FREQUENCIES	RECEIVER FREQUENCIES
		CARRIER SQUELCH MODELS			
TUE1314AB	UNIFIED CHASSIS (470-494 MHz) 1-FREQ.	U24BBA-1000AA	14 W	1	1
TUE1315AB	UNIFIED CHASSIS (494-512 MHz) 1-FREQ.	U24BBA-1100AA	14 W	1	1
TUE1314AK	UNIFIED CHASSIS (470-494 MHz) 4-FREQ.	U24BBA-1300AA	14 W	2	2
TUE1315AK	UNIFIED CHASSIS (494-512 MHz) 4-FREQ.	U24BBA-1900AA	14 W	4	4
TUE1191BB	UNIFIED CHASSIS (450-470 MHz) 1-FREQ.	U34BBA-1000AA	22/25 W	1	1
TUE1221BK	UNIFIED CHASSIS (450-470 MHz) 4-FREQ.	U34BBA-1100AA	22/25 W	2	1
KXN1002A	RESONATOR, TRANSMITTER	U34BBA-1300AA	22/25 W	2	2
K1018A	RESONATOR, RECEIVER	U34BBA-1900AA	22/25 W	4	4
THN6113A	FRONT PANEL & HOUSING				
TLN4474A	TUNING TOOL KIT				
TLN4445A	MICROPHONE HANG-UP BOX				
TLN4448A	"PRIVATE-LINE" ENCODER-DECODER BOARD KIT				
TLN6824A	"VIBRASENDER" RESONANT REED				
TLN8381A	"VIBRASPONDER" RESONANT REED				
		"PRIVATE-LINE" TONE-CODED SQUELCH MODELS			
		U24BBA-3000AA	14 W	1	1
		U24BBA-3100AA	14 W	2	1
		U24BBA-3300AA	14 W	2	2
		U24BBA-3900AA	14 W	4	4
		U34BBA-3000AA	22/25 W	1	1
		U34BBA-3100AA	22/25 W	2	1
		U34BBA-3300AA	22/25 W	2	2
		U34BBA-3900AA	22/25 W	4	4

EPS-17016-O

UNIFIED CHASSIS KIT COMPLEMENT

KIT	DESCRIPTION	TUE1191BB 1-F 450-470 MHz	TUF1221BK 4-F 450-470 MHz	TUE1314AB 1-F 470-494 MHz	TUE1315AB 1-F 494-512 MHz	TUF1314AK 4-F 470-494 MHz	TUF1315AK 4-F 494-512 MHz
TFE6153A	Harmonic Filter	X	X				
TFE6154A	Harmonic Filter			X		X	
TFE6155A	Harmonic Filter (494-512 MHz)				X		X
TFN1000AS	Receiver Filter	X	X	X	X	X	X
TKN6491B	Interconnect Cable (1-Freq.)	X		X	X		
TKN6492B	Interconnect Cable (4-Freq.)		X			X	X
TLE1552A	Power Amplifier (450-470 MHz)	X	X				
	Includes:						
TLE8142A	Power Amplifier Board						
TLN4837A	Heatsink & Hardware Kit						
TLE1553A	Power Amplifier (470-494 MHz)			X		X	
	Includes:						
TLE8143A	Power Amplifier Board						
TLN4837A	Heatsink & Hardware Kit						
TLE1554A	Power Amplifier (494-512 MHz)				X		X
	Includes:						
TLE8144A	Power Amplifier Board						
TLN4837A	Heatsink & Hardware Kit						
TLE6573A	Varactor Multiplier (450-470 MHz)	X	X				
TLE6574A	Varactor Multiplier (470-494 MHz)			X		X	
TLE6575A	Varactor Multiplier (494-512 MHz)				X		X
TLE6583A	RF Deck Kit (450-470 MHz)	X	X				
TLE6584A	RF Deck Kit (470-494 MHz)			X		X	
TLE6585A	RF Deck Kit (494-512 MHz)				X		X
TLE6603A	Injection Tripler Kit (450-470 MHz)	X	X				
TLE6604A	Injection Tripler Kit (470-494 MHz)			X		X	
TLE6605A	Injection Tripler Kit (494-512 MHz)				X		X
TLN4473A	Antenna Switch Kit	X	X	X	X	X	X
TLN4476A	Antenna Switch Kit	X	X	X	X	X	X
TLN4836A	Chassis & Hardware Kit	X	X	X	X	X	X
TLN8427A	Negative Ground Plug Kit	X	X	X	X	X	X
TLE6612B	Multi-Frequency Board (450-470 MHz)		X				
TLE6613B	Multi-Frequency Board (470-494 MHz)					X	
TLE6614B	Multi-Frequency Board (494-512 MHz)						X
TLE6592B	1-Frequency Board (450-470 MHz)	X					
TLE6593B	1-Frequency Board			X			
TLE6594B	1-Frequency Board (494-512 MHz)				X		

EPS-17019-O

MOTOROLA

MODEL CHART

FOR

450-512 MHz

"MOCOM • 70" RADIO SETS

TRUNK-MOUNT PACKAGE MODELS

CODE:

[X] = ONE ITEM SUPPLIED

( ) SEE BASIC RADIO SET CHART FOR RADIO SET COMPLEMENT.

ITEM	DESCRIPTION
TCN6098CE	CONTROL HEAD (1-FREQ.) DUAL-PURPOSE W/DIMMER
TCN6136BF	CONTROL HEAD (C2-R1) DUAL-PURPOSE W/DIMMER
TCN6098CF	CONTROL HEAD (2-FREQ.) DUAL-PURPOSE W/DIMMER
TCN6098CJ	CONTROL HEAD (4-FREQ.) DUAL-PURPOSE W/DIMMER
TKN6055A	CABLE KIT (17-FT) SINGLE-FREQ.
TKN6056A	CABLE KIT (17-FT) MULTI-FREQ.
TAE6052A	ANTENNA (450-470 MHz)
TAE6054A	ANTENNA (470-512 MHz)
TAE6062A	ANTENNA (450-470 MHz)
TLN6042A	INSTALLATION KIT
TMN6013A	MICROPHONE
TSN6000A	SPEAKER

MODEL NUMBER	BASIC RADIO SET(*)	DESCRIPTION	RF POWER
		CARRIER SQUELCH MODELS	
T24BBA-1000AK	U24BBA-1000AA	1-FREQUENCY	14 W
T24BBA-1100AK	U24BBA-1100AA	2-FREQ. XMIT, 1-FREQ. RECEIVE	14 W
T24BBA-1300AK	U24BBA-1300AA	2-FREQUENCY	14 W
T24BBA-1900AK	U24BBA-1900AA	4-FREQUENCY	14 W
T34BBA-1000AK	U34BBA-1000AA	1-FREQUENCY	22/25 W
T34BBA-1100AK	U34BBA-1100AA	2-FREQ. XMIT, 1-FREQ. RECEIVE	22/25 W
T34BBA-1300AK	U34BBA-1300AA	2-FREQUENCY	22/25 W
T34BBA-1900AK	U34BBA-1900AA	4-FREQUENCY	22/25 W
		"PRIVATE-LINE" TONE-CODED SQUELCH MODELS	
T24BBA-3000AK	U24BBA-3000AA	1-FREQUENCY	14 W
T24BBA-3100AK	U24BBA-3100AA	2-FREQ. XMIT, 1-FREQ. RECEIVE	14 W
T24BBA-3300AK	U24BBA-3300AA	2-FREQUENCY	14 W
T24BBA-3900AK	U24BBA-3900AA	4-FREQUENCY	14 W
T34BBA-3000AK	U34BBA-3000AA	1-FREQUENCY	22/25 W
T34BBA-3100AK	U34BBA-3100AA	2-FREQ. XMIT, 1-FREQ. RECEIVE	22/25 W
T34BBA-3300AK	U34BBA-3300AA	2-FREQUENCY	22/25 W
T34BBA-3900AK	U34BBA-3900AA	4-FREQUENCY	22/25 W

ITEM	T24BBA-1000AK	T24BBA-1100AK	T24BBA-1300AK	T24BBA-1900AK	T34BBA-1000AK	T34BBA-1100AK	T34BBA-1300AK	T34BBA-1900AK	T24BBA-3000AK	T24BBA-3100AK	T24BBA-3300AK	T24BBA-3900AK	T34BBA-3000AK	T34BBA-3100AK	T34BBA-3300AK	T34BBA-3900AK
TCN6098CE	X				X				X				X			
TCN6136BF		X				X				X				X		
TCN6098CF			X				X				X				X	
TCN6098CJ				X				X				X				X
TKN6055A	X				X				X				X			
TKN6056A		X	X	X		X	X	X		X	X	X		X	X	X
TAE6052A					X			X	X				X		X	X
TAE6054A	X	X	X	X					X	X	X	X				
TAE6062A						X								X		
TLN6042A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
TMN6013A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
TSN6000A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

EPS-17017-O

MOTOROLA

MODEL CHART

FOR

450-512 MHz

"MOCOM • 70" RADIO SETS

DASH-MOUNT PACKAGE MODELS

CODE:

[X] ONE ITEM SUPPLIED

( ) = SEE BASIC RADIO SET CHART FOR RADIO SET COMPLEMENT.

ITEM	DESCRIPTION
TCN6141BE	CONTROL HEAD (1-FREQ.) DUAL-PURPOSE W/DIMMER
TCN6141BF	CONTROL HEAD (2-FREQ.) DUAL-PURPOSE W/DIMMER
TCN6141BJ	CONTROL HEAD (4-FREQ.) DUAL-PURPOSE W/DIMMER
TAE6052A	ANTENNA (450-470 MHz)
TAE6054A	ANTENNA (470-512 MHz)
TLN4208A	INSTALLATION KIT
TMN6013A	MICROPHONE
TSN6000A	SPEAKER

MODEL NUMBER	BASIC RADIO SET(*)	DESCRIPTION	RF POWER	D24BBA-1000AK	D24BBA-1300AK	D24BBA-1900AK	D34BBA-1000AK	D34BBA-1300AK	D34BBA-1900AK	D24BBA-3000AK	D24BBA-3300AK	D24BBA-3900AK	D34BBA-3000AK	D34BBA-3300AK	D34BBA-3900AK
		CARRIER SQUELCH MODELS													
D24BBA-1000AK	U24BBA-1000AA	1-FREQUENCY	14 W	X											
D24BBA-1300AK	U24BBA-1300AA	2-FREQUENCY	14 W		X										
D24BBA-1900AK	U24BBA-1900AA	4-FREQUENCY	14 W			X									
D34BBA-1000AK	U34BBA-1000AA	1-FREQUENCY	22/25 W				X								
D34BBA-1300AK	U34BBA-1300AA	2-FREQUENCY	22/25 W					X							
D34BBA-1900AK	U34BBA-1900AA	4-FREQUENCY	22/25 W						X						
		"PRIVATE-LINE" TONE-CODED SQUELCH MODELS													
D24BBA-3000AK	U24BBA-3000AA	1-FREQUENCY	14 W							X					
D24BBA-3300AK	U24BBA-3300AA	2-FREQUENCY	14 W								X				
D24BBA-3900AK	U24BBA-3900AA	4-FREQUENCY	14 W									X			
D34BBA-3000AK	U34BBA-3000AA	1-FREQUENCY	22/25 W										X		
D34BBA-3300AK	U34BBA-3300AA	2-FREQUENCY	22/25 W											X	
D34BBA-3900AK	U34BBA-3900AA	4-FREQUENCY	22/25 W												X
TCN6141BE				X			X			X			X		
TCN6141BF					X			X			X			X	
TCN6141BJ						X			X			X			X
TAE6052A							X	X	X				X	X	X
TAE6054A				X	X	X				X	X	X			
TLN4208A				X	X	X	X	X	X	X	X	X	X	X	X
TMN6013A				X	X	X	X	X	X	X	X	X	X	X	X
TSN6000A				X	X	X	X	X	X	X	X	X	X	X	X

EPS-17018-O

MODEL CHART

FOR

450-470 MHz

"MOCOM·70" BASIC RADIO SETS

CODE:

X = ONE ITEM SUPPLIED

= ONE ITEM SUPPLIED FOR FIVE OR LESS RADIO SETS

n = NUMBER INDICATES QUANTITY SUPPLIED

MODEL NUMBER	TRANSMITTER FREQUENCIES	RECEIVER FREQUENCIES	ITEM	DESCRIPTION
U44BBN-1110A	"PRIVATE-LINE" TONE-CODED SQUELCH	1	TLE1552A	POWER AMPLIFIER (FORMERLY TLE1302A)
	2		TLE6502A	SINGLE-FREQ. CIRCUIT BOARD
		2	TLE6612A	TWO & FOUR-FREQ. CIRCUIT BOARD
U44BBN-1190A	"PRIVATE-LINE" TONE-CODED SQUELCH	1	TLE6573A	VARACTOR MULTIPLIER
	2		TLE6553A	HARMONIC FILTER
		2	TFN1000AS	RECEIVER FILTER (FORMERLY TFN6027AS)
U44BBN-1130A	WIDE-SPACED TRANSMITTER CHANNELS CARRIER SQUELCH	1	TLE6583A	RF DECK
	2		TLE6603A	INJECTION TRIPLER
		2	TLN4473A	POWER-TEMPERATURE MONITOR CIRCUIT BOARD
U44BBN-3190A	WIDE-SPACED TRANSMITTER CHANNELS CARRIER SQUELCH	1	TLN4475A	CHASSIS AND HARDWARE KIT
	2		TKN6491A	INTERCABLING KIT, SINGLE-FREQUENCY
		2	TKN6492A	INTERCABLING KIT, MULTI-FREQUENCY
U44BBN-3130A	"PRIVATE-LINE" TONE-CODED SQUELCH	1	TLN6824A	"VIBRASENDER" RESONANT REED
U44BBN-3190A	"PRIVATE-LINE" TONE-CODED SQUELCH	1	TLN8381A	"VIBRASPONDER" RESONANT REED
			TLN4448A	"PRIVATE-LINE" ENCODER-DECODER CIRCUIT BOARD
U44BBN-1100A		1	THN6113A	HOUSING KIT
U44BBN-1130A		2	TLN4474A	TUNING TOOL KIT
U44BBN-1190A		2	TLN3427A	NEGATIVE GROUND KIT
U44BBN-3100A	"PRIVATE-LINE" TONE-CODED SQUELCH	1	TLN4476A	ANTENNA SWITCH
U44BBN-3130A	WIDE-SPACED TRANSMITTER CHANNELS CARRIER SQUELCH	1	KXN1002A	CHANNEL RESONATOR, TRANSMITTER (FORMERLY K1017A)
U44BBN-3190A	WIDE-SPACED TRANSMITTER CHANNELS CARRIER SQUELCH	1	K1018A	CHANNEL RESONATOR, RECEIVER

EPS-7478-A

MODEL CHART

FOR

470-512 MHz

"MOCOM-70" BASIC RADIO SET

CODE

- [X] = ONE ITEM SUPPLIED
- [/] = ONE ITEM SUPPLIED DEPENDENT ON FREQUENCY RANGE
- [#] = ONE ITEM SUPPLIED FOR FIVE OR LESS RADIO SETS
- [2] = NUMBER INDICATES QUANTITY SUPPLIED

MODEL NUMBER	RF POWER	TRANSMITTER FREQUENCIES	RECEIVER FREQUENCIES	ITEM	DESCRIPTION
CARRIER SQUELCH MODELS					
U24BCA-1010AA	1 W	1	1	TLE1554A	POWER AMPLIFIER (470-494 MHz) FORMERLY TLE1304A
U24BCA-1210AA	10 W	2	2	TLE1554A	POWER AMPLIFIER (494-512 MHz) FORMERLY TLE1304A
U24BCA-1410AA	10 W	4	4	TLE6575A	SINGLE FREQUENCY CIRCUIT BOARD (470-494 MHz)
U34BCA-1010AA	22 W	1	1	TLE6575A	SINGLE FREQUENCY CIRCUIT BOARD (494-512 MHz)
U34BCA-1210AA	22 W	2	2	TLE6604A	TWO & FOUR FREQUENCY CIRCUIT BOARD (470-494 MHz)
U34BCA-1410AA	22 W	4	4	TLE6604A	TWO & FOUR FREQUENCY CIRCUIT BOARD (494-512 MHz)
"PRIVATE-LINE" TONE-CODED SQUELCH MODELS				TLE6574A	VARACTOR MULTIPLIER (470-494 MHz)
U24BCA-3000AA	10 W	1	1	TLE6575A	VARACTOR MULTIPLIER (494-512 MHz)
U24BCA-3200AA	10 W	2	2	TFE6154A	HARMONIC FILTER (470-494 MHz)
U34BCA-1900AA	22 W	2	2	TFE6155A	HARMONIC FILTER (494-512 MHz)
		4	4	TFN1000AS	RECEIVER FILTER
U24BCA-3900AA	10 W	4	4	TLE6584A	RF DECK (470-494 MHz)
U34BCA-3000AA	22 W	1	1	TLE6585A	RF DECK (494-512 MHz)
U34BCA-3360AA	22 W	2	2	TLE6604A	INJECTION TRIPLER (470-494 MHz)
U34BCA-3900AA	22 W	4	4	TLE6605A	INJECTION TRIPLER (494-512 MHz)
WIDE-SPACED TRANSMITTER CHANNELS				TLN4473A	POWER-TEMPERATURE MONITOR CIRCUIT BOARD
CARRIER SQUELCH MODELS				TLN4836A	CHASSIS AND HARDWARE KIT
U24BCA-1103AA	10 W	2	1	TKN6491A	INTERCABLING KIT, SINGLE-FREQUENCY
U34BCA-1103AA	22 W	2	1	TKN6992A	INTERCABLING KIT, MULTI-FREQUENCY
PRIVATE-LINE TONE-CODED SQUELCH MODELS				TLN6824A	VIBRASONDER RESONANT REED
U24BCA-3103AA	10 W	2	1	TLN6824A	VIBRASONDER RESONANT REED
U34BCA-3103AA	22 W	2	1	TLN4448A	PRIVATE-LINE ENCODER-DECODER CIRCUIT BOARD
				THN6113A	HEADSET KIT
				TLN4474A	TUNING TOOL KIT
				TLN8427A	NEGATIVE GROUND KIT
				TLN4476A	ANTENNA MATCH
				RXN1002A	CHANNEL DESIGNATOR, TRANSMITTER
				R1518A	CHANNEL DESIGNATOR, RECEIVER

EPS 8064 A

MOTOROLA

MODEL CHART

FOR

450-470 MHz

"MOCOM · 70" RADIO SETS

WITH ACCESSORIES

VERSION 2

CODE:

[X] = ONE ITEM SUPPLIED

[/] = ONE ITEM SUPPLIED DEPENDENT ON FREQUENCY RANGE.

*SEE BASIC RADIO SET MODEL CHART FOR RADIO SET COMPLEMENT

| ITEM | DESCRIPTION | DESCRIPTION | DASH MOUNT RADIO SET | CARRIER SQUELCH | 1-FREQUENCY | D44BBN-1100BK | U44BBN-1100A | 2-FREQUENCY | D44BBN-1130BK | U44BBN-1130A | MULTI-FREQUENCY | D44BBN-1190BK | U44BBN-1190A | "PRIVATE-LINE" TONE-CODED SQUELCH | 1-FREQUENCY | D44BBN-3100BK | U44BBN-3100A | 2-FREQUENCY | D44BBN-3130BK | U44BBN-3130A | MULTI-FREQUENCY | D44BBN-3190BK | U44BBN-3190A | TRUNK MOUNT RADIO SET | CARRIER SQUELCH | 1-FREQUENCY | T44BBN-1100BK | U44BBN-1100A | 2-FREQUENCY | T44BBN-1130BK | U44BBN-1130A | MULTI-FREQUENCY | T44BBN-1190BK | U44BBN-1190A | "PRIVATE-LINE" TONE-CODED SQUELCH | 1-FREQUENCY | T44BBN-3100BK | U44BBN-3100A | 2-FREQUENCY | T44BBN-3130BK | U44BBN-3130A | MULTI-FREQUENCY | T44BBN-3190BK | U44BBN-3190A | 1-FREQUENCY | T44BBN-1100CK | U44BBN-1100CK | 2-FREQUENCY | T44BBN-1130CK | U44BBN-1130CK | MULTI-FREQUENCY | T44BBN-1190CK | U44BBN-1190CK | "PRIVATE-LINE" TONE-CODED SQUELCH | 1-FREQUENCY | T44BBN-3100CK | U44BBN-3100CK | 2-FREQUENCY | T44BBN-3130CK | U44BBN-3130CK | MULTI-FREQUENCY | T44BBN-3190CK | U44BBN-3190CK | WIDE-SPACED TRANSMITTER CHANNELS | CARRIER SQUELCH | 1-FREQUENCY RECEIVER, 2-FREQUENCY TRANSMITTER | T44BBN-1110BK | U44BBN-1110A | "PRIVATE-LINE" TONE-CODED SQUELCH | 1-FREQUENCY RECEIVER, 2-FREQUENCY TRANSMITTER | T44BBN-3110BK | U44BBN-3110A |
|---|---|---

MOTOROLA

MODEL CHART

FOR

450-470 MHz

"MOCOM - 70" RADIO SETS

WITH ACCESSORIES

VERSION 1

CODE:

[X] = ONE ITEM SUPPLIED

***SEE BASIC RADIO SET MODEL CHART FOR RADIO SET COMPLEMENT**

ITEM	DESCRIPTION	PACKAGE MODEL	BASIC RADIO SET*	DESCRIPTION
				DASH MOUNT RADIO SET
				CARRIER SQUELCH
		D44BBN-1100AK	U44BBN-1100A	1-FREQUENCY
		D44BBN-1130AK	U44BBN-1130A	2-FREQUENCY
		D44BBN-1190AK	U44BBN-1190A	MULTI-FREQUENCY
				"PRIVATE-LINE" TONE-CODED SQUELCH
		D44BBN-3100AK	U44BBN-3100A	1-FREQUENCY
		D44BBN-3130AK	U44BBN-3130A	2-FREQUENCY
		D44BBN-3190AK	U44BBN-3190A	MULTI-FREQUENCY
				TRUNK MOUNT RADIO SET
				CARRIER SQUELCH
		T44BBN-1100AK	U44BBN-1100A	1-FREQUENCY
		T44BBN-1130AK	U44BBN-1130A	2-FREQUENCY
		T44BBN-1190AK	U44BBN-1190A	MULTI-FREQUENCY
				"PRIVATE-LINE" TONE-CODED SQUELCH
		T44BBN-3100AK	U44BBN-3100A	1-FREQUENCY
		T44BBN-3130AK	U44BBN-3130A	2-FREQUENCY
		T44BBN-3190AK	U44BBN-3190A	MULTI-FREQUENCY
				WIDE-SPACED TRANSMITTER CHANNELS
				CARRIER SQUELCH
		T44BBN-1110AK	U44BBN-1110A	1-FREQUENCY RECEIVER, 2-FREQUENCY TRANSMITTER
				"PRIVATE-LINE" TONE-CODED SQUELCH
		T44BBN-3110AK	U44BBN-3110A	1-FREQUENCY RECEIVER, 2-FREQUENCY TRANSMITTER
TLN6246A	"PRIVATE-LINE" HANG-UP BOX			
TCN6141AE	CONTROL HEAD, CARRIER SQUELCH, 1-FREQ. WITH DIMMER			
TLN4208A	INSTALLATION KIT, DASH MOUNT			
TMN6013A	MICROPHONE			
TSN6000A	SPEAKER			
TAE6052A	ANTENNA			
TCN6141AF	CONTROL HEAD, CARRIER SQUELCH, 2-FREQ. WITH DIMMER			
TCN6141AJ	CONTROL HEAD, CARRIER SQUELCH, 4-FREQ. WITH DIMMER			
TCN6141AG	CONTROL HEAD, "PRIVATE-LINE" TONE-CODED SQUELCH, 1-FREQ. WITH DIMMER			
TCN6141AH	CONTROL HEAD, "PRIVATE-LINE" TONE-CODED SQUELCH, 2-FREQ. WITH DIMMER			
TCN6141AK	CONTROL HEAD, "PRIVATE-LINE" TONE-CODED SQUELCH, 4-FREQ. WITH DIMMER			
TCN6026AE	CONTROL HEAD, CARRIER SQUELCH, 1-FREQ.			
TKN6055A	CABLE KIT, TRUNK MOUNT, SINGLE FREQ.			
TLN6042A	INSTALLATION KIT, TRUNK MOUNT			
TCN6026AF	CONTROL HEAD, CARRIER SQUELCH, 2-FREQ.			
TKN6056A	CABLE KIT, TRUNK MOUNT, MULTI-FREQ.			
TCN6026AJ	CONTROL HEAD, CARRIER SQUELCH, 4-FREQ.			
TCN6026AG	CONTROL HEAD, "PRIVATE-LINE" TONE-CODED SQUELCH, 1-FREQ.			
TCN6026AH	CONTROL HEAD, "PRIVATE-LINE" TONE-CODED SQUELCH, 2-FREQ.			
TCN6026AK	CONTROL HEAD, "PRIVATE-LINE" TONE-CODED SQUELCH, 4-FREQ.			
TCN6136AF	CONTROL HEAD, CARRIER SQUELCH, C2-R1, WITH DIMMER			
TCN6136AH	CONTROL HEAD, "PRIVATE-LINE" TONE-CODED SQUELCH, C2-R1 WITH DIMMER			
TAE6062A	ANTENNA			

EPS-4831-A

MOTOROLA

MODEL CHART

FOR

470-512 MHz

'MOCOM' 70" RADIO SETS

WITH ACCESSORIES

CODE

SEE BASIC RADIO SET MODEL CHART FOR RADIO SET COMPLEMENT

[X] ONE ITEM SUPPLIED

[▨] OPTIONAL ANTENNA. THE ANTENNA USED WITH THE RADIO SET DETERMINES EFFECTIVE RADIATED POWER (ERP) AS FOLLOWS:

ANTENNA	RADIO SET RF POWER	ERP
TAE6074A (Unity Gain)	16 W	13 W
TAE6074A/75A (3-1/2 dB Gain)	16 W	25 W
TAE6074A/75A (6 dB Gain)	22 W	50 W

OTHER COMBINATIONS OF RADIOS AND ANTENNAS ARE NOT RECOMMENDED.

PACKAGE MODEL	BASIC RADIO SET*	RF POWER	TRANSMITTER FREQUENCIES	RECEIVER FREQUENCIES
		DASH MOUNT RADIO SET		
		CARRIER SQUELCH		
D24BCA-1000AK	U24BCA-1000AA	16 W	1	1
D24BCA-1300AK	U24BCA-1300AA	16 W	2	2
D24BCA-1900AK	U24BCA-1900AA	16 W	4	4
D34BCA-1000AK	U34BCA-1000AA	22 W	1	1
D34BCA-1300AK	U34BCA-1300AA	22 W	2	2
D34BCA-1900AK	U34BCA-1900AA	22 W	4	4
		"PRIVATE-LINE" TONE-CODED SQUELCH		
D24BCA-3000AK	U24BCA-3000AA	16 W	1	1
D24BCA-3300AK	U24BCA-3300AA	16 W	2	2
D24BCA-3900AK	U24BCA-3900AA	16 W	4	4
D34BCA-3000AK	U34BCA-3000AA	22 W	1	1
D34BCA-3300AK	U34BCA-3300AA	22 W	2	2
D34BCA-3900AK	U34BCA-3900AA	22 W	4	4
		TRUNK MOUNT RADIO SET		
		CARRIER SQUELCH		
T24BCA-1000AK	U24BCA-1000AA	16 W	1	1
T24BCA-1300AK	U24BCA-1300AA	16 W	2	2
T24BCA-1900AK	U24BCA-1900AA	16 W	4	4
T34BCA-1000AK	U34BCA-1000AA	22 W	1	1
T34BCA-1300AK	U34BCA-1300AA	22 W	2	2
T34BCA-1900AK	U34BCA-1900AA	22 W	4	4
T24BCA-1000BK	U24BCA-1000AA	16 W	1	1
T24BCA-1300BK	U24BCA-1300AA	16 W	2	2
T24BCA-1900BK	U24BCA-1900AA	16 W	4	4
T34BCA-1000BK	U34BCA-1000AA	22 W	1	1
T34BCA-1300BK	U34BCA-1300AA	22 W	2	2
T34BCA-1900BK	U34BCA-1900AA	22 W	4	4
		"PRIVATE-LINE" TONE-CODED SQUELCH		
T24BCA-3000AK	U24BCA-3000AA	16 W	1	1
T24BCA-3300AK	U24BCA-3300AA	16 W	2	2
T24BCA-3900AK	U24BCA-3900AA	16 W	4	4
T34BCA-3000AK	U34BCA-3000AA	22 W	1	1
T34BCA-3300AK	U34BCA-3300AA	22 W	2	2
T34BCA-3900AK	U34BCA-3900AA	22 W	4	4
T24BCA-3000BK	U24BCA-3000AA	16 W	1	1
T24BCA-3300BK	U24BCA-3300AA	16 W	2	2
T24BCA-3900BK	U24BCA-3900AA	16 W	4	4
T34BCA-3000BK	U34BCA-3000AA	22 W	1	1
T34BCA-3300BK	U34BCA-3300AA	22 W	2	2
T34BCA-3900BK	U34BCA-3900AA	22 W	4	4
		WIDE-SPACED TRANSMITTER CHANNELS		
		CARRIER SQUELCH		
T24BCA-1103AK	U24BCA-1103AA	16 W	2	1
T34BCA-1103AK	U34BCA-1103AA	22 W	2	1
		"PRIVATE-LINE" TONE-CODED SQUELCH		
T24BCA-3103AK	U24BCA-3103AA	16 W	2	1
T34BCA-3103AK	U34BCA-3103AA	22 W	2	1

DESCRIPTION	KEY
CONTROL HEAD, DUAL PURPOSE, 1-FREQ. W/ DIMMER (DASH MOUNT)	
CONTROL HEAD, DUAL PURPOSE, 2-FREQ. WITH DIMMER (DASH MOUNT)	
CONTROL HEAD, DUAL PURPOSE, 4-FREQ. W/ DIMMER (DASH MOUNT)	
CONTROL HEAD, DUAL PURPOSE, 1-FREQ. (TRUNK MOUNT)	
CONTROL HEAD, DUAL PURPOSE, 2-FREQ. (TRUNK MOUNT)	
CONTROL HEAD, DUAL PURPOSE, 4-FREQ. (TRUNK MOUNT)	
CONTROL HEAD, DUAL PURPOSE, 1-FREQ. W/ DIMMER (TRUNK MOUNT)	
CABLE KIT, SINGLE-FREQ. (TRUNK MOUNT)	
CABLE KIT, MULTI-FREQ. (TRUNK MOUNT)	
MICROPHONE	
SPEAKER	
HANG-UP SWITCH BOX 'PRIVATE-LINE'	
ANTENNA, WHIP, 470-512 MHz	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
ANTENNA, 470-494 MHz (3-1/2 dB Gain)	
ANTENNA, 494-512 MHz (3-1/2 dB Gain)	
INSTALLATION KIT (DASH MOUNT)	
INSTALLATION KIT (TRUNK MOUNT)	
CONTROL HEAD, DUAL PURPOSE, 1-FREQ. W/ DIMMER (TRUNK MOUNT)	TCN6098CE
CONTROL HEAD, DUAL PURPOSE, 2-FREQ. W/ DIMMER (TRUNK MOUNT)	TCN6098CF
CONTROL HEAD, DUAL PURPOSE, 4-FREQ. W/ DIMMER (TRUNK MOUNT)	TCN6098CJ

EPS-8065-C

DESCRIPTION

1. INTRODUCTION

The Motorola "Mocom•70" radios are completely transistorized mobile FM two-way units which fully utilize the advantages of solid-state circuits -- reliability, small size, ruggedness and low maintenance requirements. Current demands are low, since tube filaments are eliminated and unheated crystals are used for frequency control.

These radio sets can utilize existing "Motrac" accessories. The units may be installed so that the control head ON-OFF switch turns on the transmitter and receiver or the receiver alone. In the latter case, power for the transmitter is routed through the vehicle ignition switch, so that transmission is impossible unless the ignition switch is turned on.

A variety of models are available which provide carrier squelch or "Private-Line" tone-coded squelch operation. The model chart at the front of this manual lists the available models.

2. TRANSMITTERS

Complete transistorization of the FM transmitter and the use of unheated crystals allow instantaneous on-frequency transmission over an ambient temperature range of -30°C to +60°C as soon as power is applied. Modulation is effected by a direct frequency modulator. The frequency of the modulated signal is multiplied and then applied to the amplifier output stages. The output frequency is 27 times the crystal frequency. A high level of spurious frequency attenuation is achieved in a four section harmonic filter in the transmitter output. The transmitter provides a minimum output of 25 watts in the 450-470 MHz range and an effective radiated power of 10 watts, 25 watts or 50 watts in the 470-512 MHz range.

3. RECEIVERS

The receivers used in these radio sets are crystal-controlled, dual conversion models which provide five watts of audio power. A highly selective rf preselector (tuned cavities), a high i-f crystal filter and a sealed, life-time guaranteed "Permakay" filter in the low i-f stages determine the excellent bandwidth and selectivity characteristics of the receivers. Plug-in resonators provide stable frequency control.

These models include a noise-actuated squelch circuit consisting of a noise limiter, a noise detector and a dc control stage (switching circuit) to cut off the audio amplifier. This eliminates disturbing noise which would otherwise be heard at the speaker during intervals between received messages.

4. "DIGITAL PRIVATE-LINE" (DPL) AND TONE "PRIVATE-LINE" (TPL) SQUELCH MODELS

This type of radio set is an improvement in FM two-way radio equipment especially when operating under crowded channel conditions. Several networks, using either DPL or TPL, can use the same rf carrier frequency in the same area if each network uses a different code (in DPL) or a different tone (in TPL).

The transmitters are modulated by a continuous sub-audible code signal (digital or tone) in addition to the voice modulation. The receivers accept only signals which are modulated with the correct tone or digital code and reject all others.

Both DPL and TPL squelch models also include noise-actuated squelch circuitry as previously described for carrier squelch models. This enables the operator to monitor the channel before transmissions and prevent interference with other users of the frequency.

In DPL or TPL squelch models, the decoding circuits are operative at all times. The monitor-operate switch and the hook-switch on the hang-up switch box, when a dual-purpose control head is used, places the noise-actuated squelch circuit in or out of operation.

In "Private-Line" tone-coded squelch models, the SQUELCH control determines the composite dual-squelch sensitivity. In normal operation, the receiver audio is activated only when both of the following conditions occur:

a. An on-frequency rf signal must be received to disable the noise (carrier squelch) circuit.

b. The on-frequency rf signal must be FM modulated with the proper sub-audible tone frequency to activate the "Private-Line" decoder. In "Digital Private-Line" binary-coded squelch models, squelch is only controlled by the "Digital Private-Line" decoder output.

5. NETTING FEATURES

The netting feature provides a quick method of checking the frequency of either the transmitter or the receiver if both are aligned to the same frequency and if one is known to be "on-frequency". With the Motorola Portable Test Set, the test can be made in one simple operation.

Plug the test set into either meter socket and switch the test set meter to position #4. The meter will indicate the discriminator output. Remote one end of the wire netting jumper, located near L105 in the exciter from its normal pin and connect it to the pin located near CR180 in the exciter IDC circuit. This energizes the low level stages of the transmitter exciter and causes a signal to be radiated to the receiver. The receiver or transmitter oscillator can then be "warped" on-frequency by adjusting for zero discriminator output.

6. HOUSING

The basic radio set consists of a transmitter and receiver housed together to form a drawer unit which slides into the #16 gauge housing. All external connections are made through receptacles on the front panel.

The radio set housing can be mounted either under the vehicle dashboard or in the trunk. The same drawer assembly, including transmitter and receiver, slides into the housing in either type of installation. In mobile radio fleets, where both dash- and trunk-mount installations are used, this design provides full flexibility in exchanging radio sets between vehicles. Trunk-mounted radio sets are remotely controlled by means of a dash-mounted control head.

A removable handle is attached to the front panel. It can be removed by loosening the two screws located on the bottom ends of the handle. A key lock is also mounted on the front panel to secure the radio from unauthorized persons.

For servicing purposes, the major chassis is easily accessible by removing the drawer unit from the housing. Refer to the SERVICE AIDS section of this manual for instructions on the removal of individual components.

7. ACCESSORIES

In addition to the basic radio set, accessories are required to complete the installation. Various combinations of accessories are available to meet specific requirements. The accessories are listed in the Model Chart in the front part of this manual.

The control heads available as one of the accessories provide all the required control facilities for operation of the radio set. The dash-mount control heads plug directly into the front panel when the handle is removed. Control heads for trunk-mounted units have an adjustable angle-bracket for mounting to the vehicle dash and are connected to the radio set via a cable kit.

The microphone used with the radio set is a palm-type microphone with a transistorized preamplifier. The microphone has a 12-inch tinsel coiled-cord and a four-pin connector for plugging into the receptacle on the control head.

A special mounting kit is included with the dash-mount accessories to mount the radio set in the passenger compartment of the vehicle.

8. OPTIONAL ACCESSORIES

The following options are available to meet specific customer requirements:

- TLN1097A Time-Out Timer - This option prevents extended transmitter keying.

- TLN8482A Ground Reversing Kit - This kit is required for positive ground operation.

- Dimmer Control Head - This option is available for all trunk-mounted radio set control heads. (Dash-mount dimmer control heads are standard equipment.)

- TLE6532A Receiver Preamplifier - This option improves receiver sensitivity by 6 dB, thereby extending the range of communications.

Additional options are available that allow the customer to delete antennas, speakers, microphones or "Private-Line" hang-up brackets from the package model equipment complements.

Many other accessories are available; some are given here. Contact your local Motorola Radio Communications Representative for complete details or for information on other accessories.

- Mobile Coaxial Antenna - where rooftop antenna is not practical or desirable.

- 5 dB Gain Antenna - for improved system performance.

- Dynamic Handset - where telephone type handset is either preferred or where speaker muting is desired for privacy.

INSTALLATION AND OPERATION

INSTALLING THE RADIO SET

Complete installation instructions are packed in the shipping carton with the radio set. Install the radio set according to the instructions supplied.

IMPORTANT

If antenna cable must be shortened, reduce power output of transmitter as indicated in the table to maintain FCC approved Effective Radiated Power (ERP). Standard cable length is 14 feet.

Antenna Model	Radio Model Series	LENGTH OF CABLE (FEET)						
		4	6	8	10	12	14	ERP
TAE6054A	T/D/U24BBA/BCA	11 W	12 W	12 W	13 W	14 W	15 W	10 W
TAE6074A or TAE6075A	T/D/U24BBA/BCA	12 W	13 W	14 W	15 W	16 W	17 W	25 W
TAE6094B or TAE6095B	T/D/U34BBA/BCA	17 W	18 W	18 W	19 W	20 W	21 W	50 W

1. OPERATING INSTRUCTIONS

CAUTION

This radio set, when supplied with a Model TLN8427A Negative Ground Kit, must be used in negative ground installations only. For positive ground installations, a Model TLN8482A Ground Reversing Kit is available. This kit must be inserted in the socket with the POS GND mark opposite the arrow on the polarity plug plate when used in positive ground installations. This ground reversing kit may be used in negative ground installations also. In such cases, the kit must be inserted in the socket with the NEG GND mark opposite the arrow on the polarity plug plate.

NOTE

Depending on the type of control head being used, the procedure for placing the radio in or out of "Private-Line" operation (hereafter refered to as PL mode) may vary. Refer to the following:

--Dual-Purpose Control Heads - these control heads do not contain a "PL" ON-OFF switch. To place the radio in the PL mode, set the monitor-operate switch on the hang-up switch box to the operate (opposite) position. To take the radio out of the PL mode, place the monitor-operate switch in the monitor ( ) position.

--All other control heads - these control heads contain a "PL" ON-OFF switch. By placing the switch in the appropriate position, the PL mode will be either on or off.

TO RECEIVE

MULTI-FREQ. MODELS ONLY	Place the frequency selector switch in the desired position.
ALL MODELS	Place the ON-OFF switch in the ON position or turn the OFF-VOLUME control clockwise. The green lamp will go on to indicate the "standby" condition. The receiver is in full operation.

TO HEAR ALL ON-FREQUENCY SIGNALS

"PRIVATE-LINE" MODELS ONLY	Take the radio out of the PL mode.
ALL MODELS	Turn the SQUELCH control to the full counterclockwise position. Turn the VOLUME control clockwise until noise is heard. Adjust the SQUELCH control by turning it slowly clockwise until the noise is just squelched (cuts out). Set the VOLUME control to the desired listening level with a received signal.

TO HEAR "PRIVATE-LINE" SIGNALS ONLY

"PRIVATE-LINE" MODELS ONLY	Take the radio out of the PL mode. Turn the SQUELCH control to the full counterclockwise position. Turn the VOLUME control clockwise until noise is heard. Adjust the SQUELCH control by turning it slowly clockwise until the noise is just squelched (cuts out). Place the radio in the PL mode. Set the VOLUME control to the desired listening level with a received signal.

TO TRANSMIT

ALL MODELS	Proceed as previously described under "TO RECEIVE" and "TO HEAR ALL ON-FREQUENCY SIGNALS". Turn "on" the vehicle ignition switch. For short transmissions it is not necessary to start the engine; however, to conserve the battery, the engine should be running. When the channel is clear, hold the microphone about one inch from the lips and turned about 30° away from the face. Press the push-to-talk button. The red lamp will come on and the transmitter will go "on the air". Speak slowly and clearly across the microphone in a normal or slightly louder than normal voice. At the end of the message, release the push-to-talk button and replace the microphone in the hang-up bracket.

CAUTION

To prevent accidental transmission or jamming of the channel by inadvertent keying of the transmitter, do not leave the microphone lying on the seat where the button may be accidentally operated.

TO TURN OFF

ALL MODELS	Place the ON-OFF switch in the OFF position -- or turn the OFF-VOLUME control counterclockwise until a click is heard.

2. LOW CURRENT DRAIN MODIFICATION

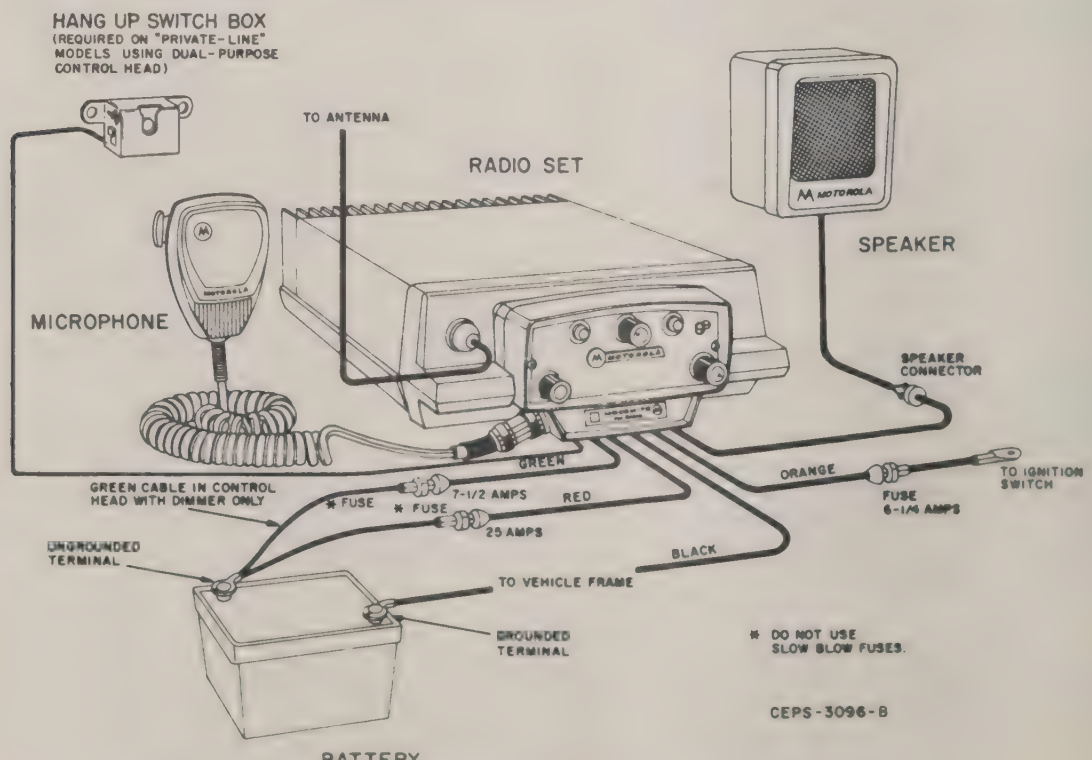
(Non-Dimmer Control Heads Only)

If desired, an additional saving in battery current drain of about 200 mA (in the standby condition) may be obtained by a wiring modification in the control head. If this modification is incorporated, the green pilot lamp will not operate unless the ignition switch is in the ON position. Proceed as follows to complete the modification.

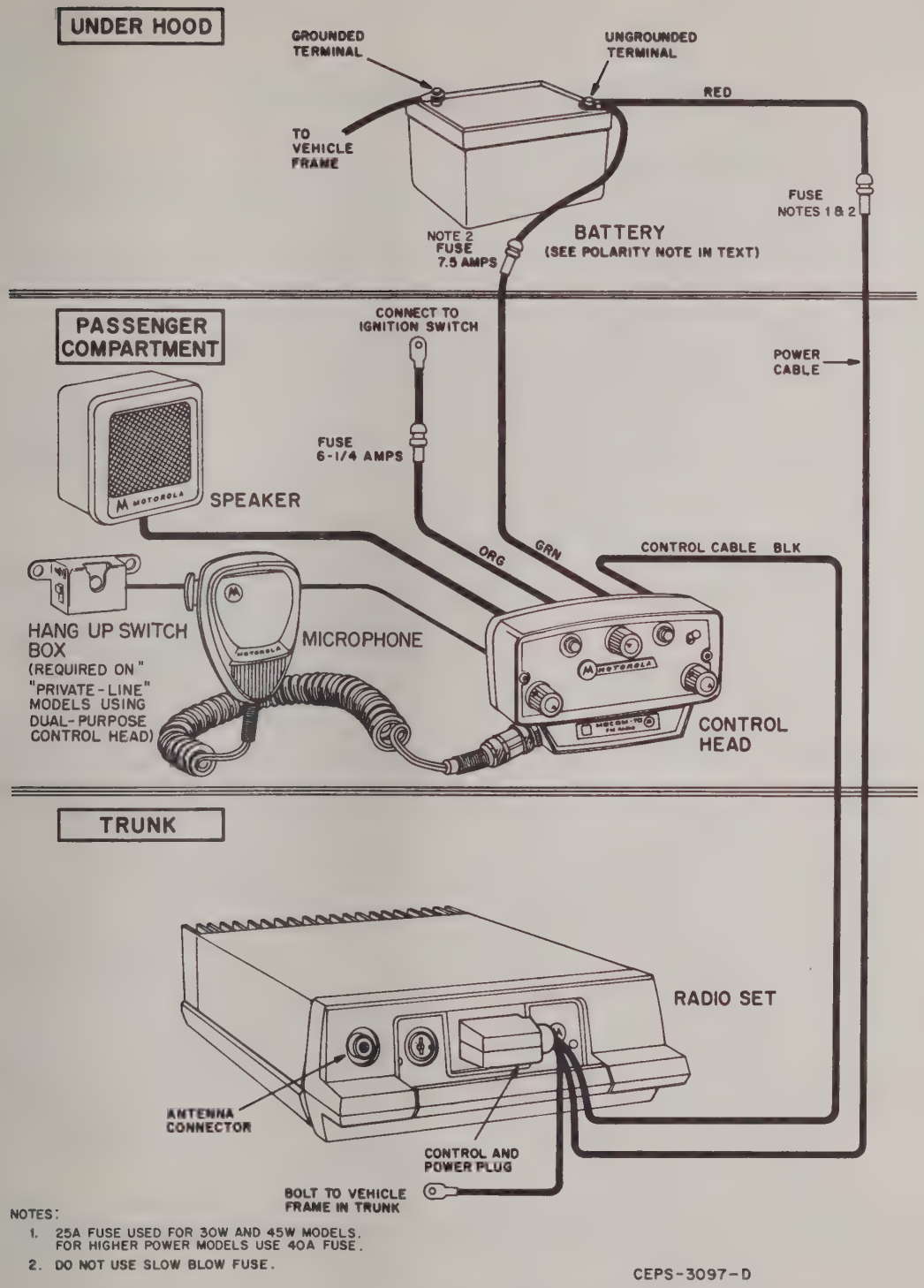
a. Loosen the two mounting screws and remove the control head.

b. Remove the end of the 33-ohm resistor attached to the green lamp from the terminal of the OFF-VOLUME control or the ON-OFF switch.

c. Connect the end of the resistor which was removed in step b. to the terminal of the OFF-VOLUME control or the ON-OFF switch to which the red lamp is connected.



Typical Dash-Mount Installation



NOTES:

1. 25A FUSE USED FOR 30W AND 45W MODELS. FOR HIGHER POWER MODELS USE 40A FUSE.
2. DO NOT USE SLOW BLOW FUSE.

CEPS-3097-D

Typical Trunk-Mount Installation

THEORY OF OPERATION

1. FUNCTIONAL OPERATION

The overall operation of the radio set is illustrated in the Functional Block Diagram in Figure 1. This diagram applies to both dash and trunk-mount installations.

The dc input to the radio is applied through three separate leads in the following manner:

-- The primary power (12 volts from the ungrounded side of the battery) is applied to the transmitter via the polarity reversing socket and the relay.

-- Power for the receiver and low level transmitter stages comes from the ungrounded terminal of the battery and passes through the OFF-ON switch (in the control head) and the polarity reversing socket.

-- The transmitter keying voltage is connected to both the vehicle ignition switch and the OFF-ON switch in the control head. This gives vehicle ignition control to transmitter operation since the push-to-talk function will be inoperative with the ignition switch turned off.

The function of the polarity reversing socket is to provide voltages of the proper polarity to the radio circuitry in either positive or negative ground installations. With the exception of the audio push-pull output stages, the receiver and some circuits within the transmitter require a voltage which is always positive with respect to chassis. In positive ground systems, this voltage is supplied by the TLN8482A Ground Reversing Kit. In negative ground systems, connections through the polarity reversing socket are supplied by the TLN8427A Negative Ground Kit or by the TLN8482A Ground Reversing Kit (see the INSTALLATION AND OPERATION section of this manual).

When the control head ON-OFF switch is turned on, the receiver is immediately operative and the green lamp on the control head lights, indicating the radio set is ON.

In negative ground operation, battery voltage (A+) is applied to:

-- The entire receiver.

-- The transmitter audio amplifier.

-- The PL encoder, decoder, and time delay circuits (in "Private-Line" radio sets only).

A regulated 9.1-volt supply (chassis referenced) is derived from the receiver A+ voltage. This regulated voltage is applied to:

-- Both the transmitter and receiver oscillators.

-- The transmitter IDC circuit.

-- The PL tone generator (in "Private-Line" radio sets only).

-- The time-out timer

In positive ground operation, the chassis referenced A+ is supplied by the converter in the TLN8482A Ground Reversing Kit. Other connections in this kit provide for maintaining the required A+ to A- polarity for the remaining circuits.

When the power ON-OFF switch and the vehicle ignition switch are both turned on, the transmitter is immediately ready for operation. When the push-to-talk button on the microphone is pressed, the following functions are performed:

-- The red lamp in the control head lights indicating a transmit condition.

-- A chassis connection is made through the push-to-talk switch to activate the relay (in "Private-Line" radios, the push-to-talk switch activates the PL time delay circuit which in turn switches the relay).

The power relay performs the following switching functions:

-- Filtered A+ is provided to operate the low level transmitter exciter stages.

-- Regulated 9.1 V is removed from the receiver oscillator and multipliers to turn them off.

-- Unfiltered A+ is provided to switch the antenna from the receiver input to the transmitter input and to operate the high level transmitter stages.

When the push-to-talk button is released, the following takes place:

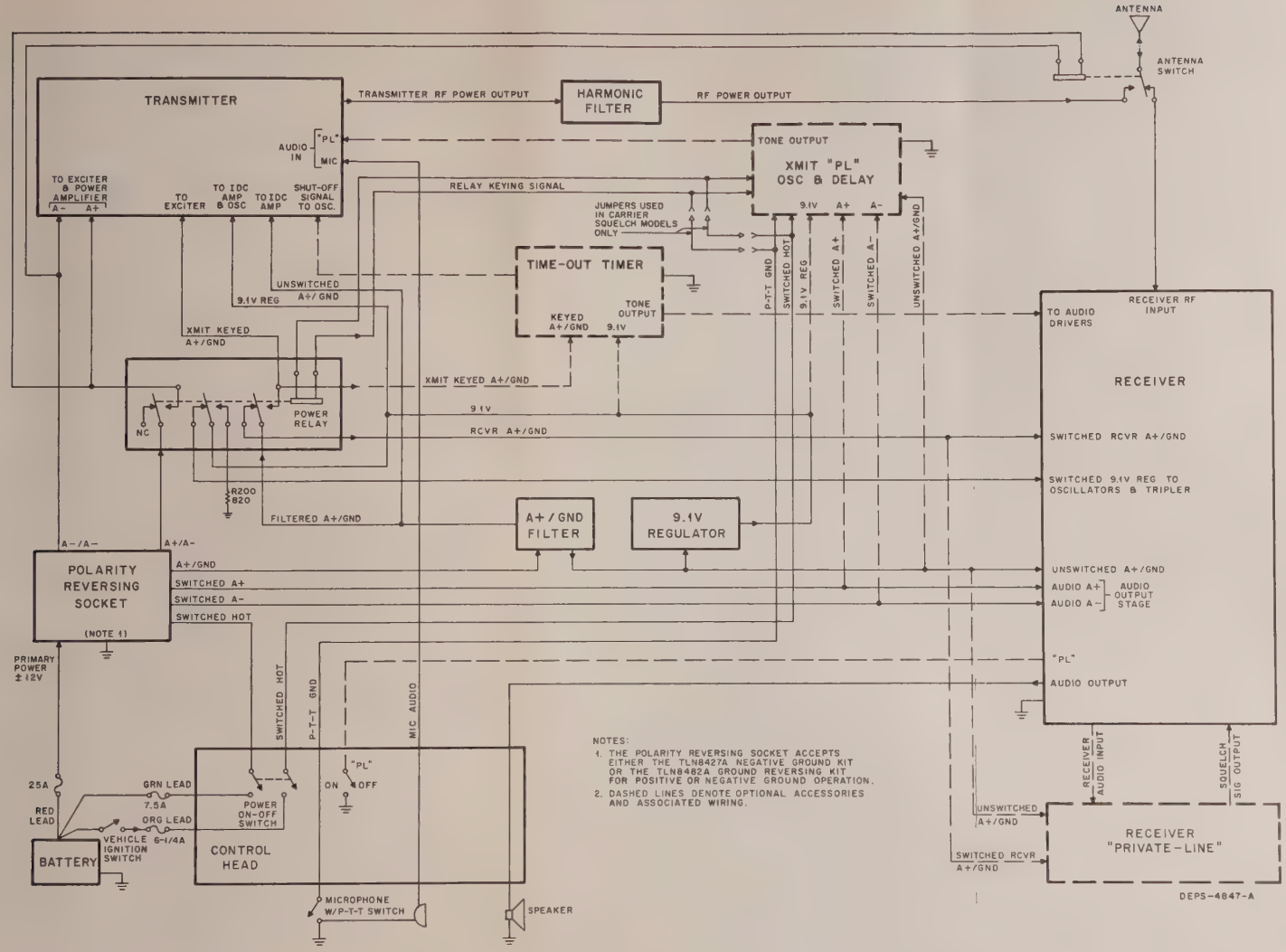


Figure 1.
Functional Block Diagram

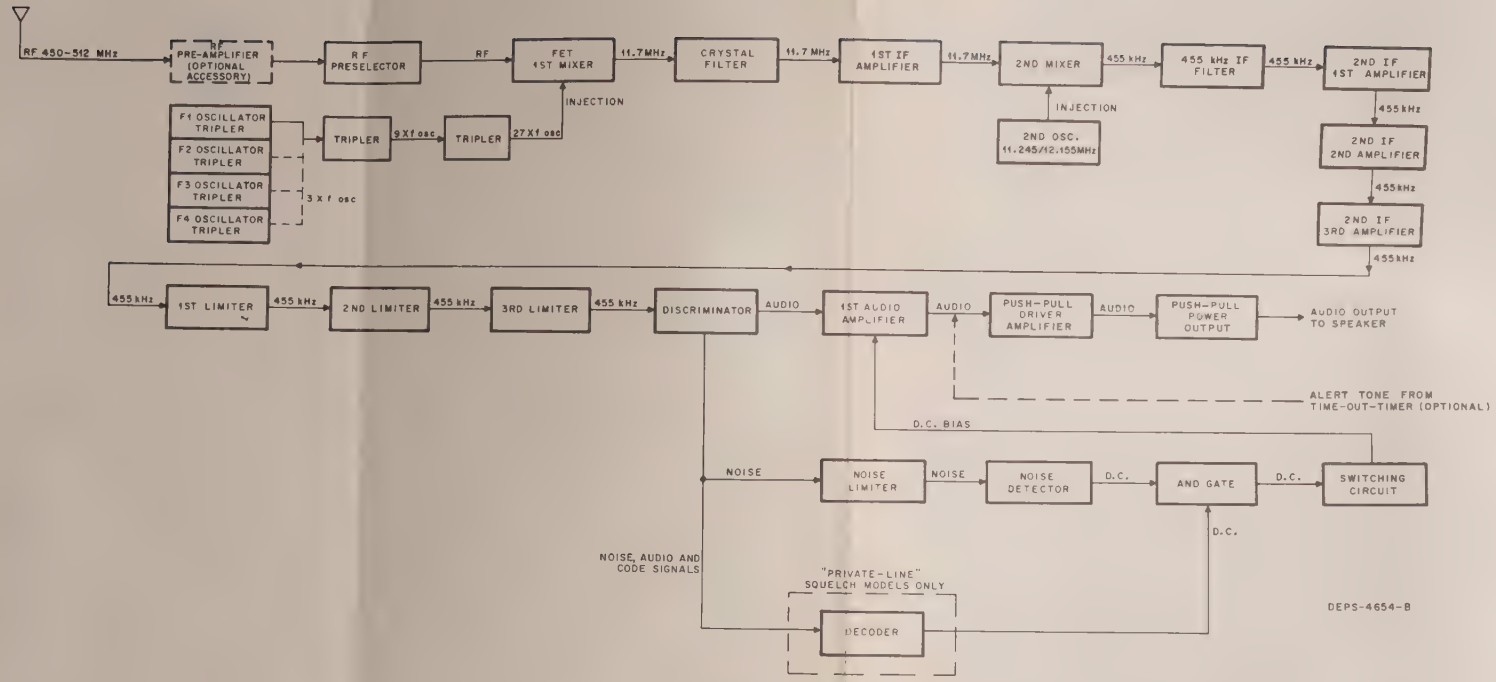


Figure 2.
Receiver Block Diagram

a. Carrier Squelch Radios

(1) The red transmit indicator lamp on the control head goes out.

(2) The power relay opens to remove A+ from all transmitter rf stages. The antenna, filtered A+, and regulated 9.1 V are switched to the receiver.

b. TPL or DPL Coded Squelch Radios

(1) The red transmit indicator lamp on the control head turns off.

(2) TPL systems only -- In this system the controlled A+ voltage to the tone generator is removed which causes a phase reversal of the tone output fed to the modulator. The path to the push-to-talk bridge is opened but a delay circuit keeps the transmitter on for approximately 150 milliseconds after release of the push-to-talk switch. During this time, the reverse burst is transmitted which damps the vibration of the "Vibrasponder" resonant reed in the listening receiver and returns it to the squelch condition. After the 150 millisecond delay, the power relay opens to remove all voltages and the radio reverts to receive operation.

(3) DPL systems only -- In this system the transmit code enable is removed from the DPL encoder; however, a delay circuit keeps the transmitter on for approximately 180 milliseconds after release of the push-to-talk switch. During this time, the DPL encoder generates a turn-off which is transmitted. The turn-off code is decoded in the listening receiver and returns it to the squelch condition. After the 180 millisecond delay, power is removed from the transmitter and the radio reverts to receive operation.

2. RECEIVER

The receiver is a completely transistorized double-conversion superheterodyne type. It receives FM signals on one (or up to four) fixed crystal-controlled frequencies.

The multi-frequency receiver is the same as the one frequency model except for the addition of three oscillator circuits. Only one frequency can be received at a time. A switch on the control head selects the desired operating frequency on multi-frequency models. The frequency selector switch completes a path to ground for the corresponding transmitter and receiver oscillators thus allowing them to operate. (Unusual receive-transmit combinations, such as two frequency transmit and three frequency receive, require minor circuit modifications.) The modifications are covered in the Service Aids Section of this manual.

a. RF Preselector

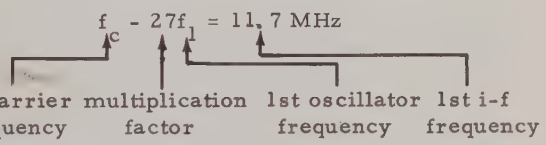
The rf signal received at the antenna is routed to the preselector via the antenna relay. The preselector has a flat noise bandwidth and a steep skirt response to provide rapid attenuation of signals outside the accepted bandwidth. Capacitive and magnetic coupling are used to couple the signal through the resonant cavity apertures. The preselector contains six low-loss, highly selective, helical resonator cavities (L1 through L6).

b. Oscillator-Multiplier

The oscillator circuit(s) consist of either one or four (multi-frequency models) Colpitts oscillators and may contain up to four temperature-compensated crystal resonators. The oscillator output is fed to a two-coil filter (L9 and L10) which is tuned to pass only the third harmonic. The injection signal then passes through two successive tripler stages which raise the frequency to 27 times the crystal frequency. Coils L11, L12 and L13 are tuned to the ninth crystal harmonic. L14, L15, and L16 (high-Q aperture tuned coils) are tuned to 27 times the crystal frequency. The injection output is then applied to the source of the FET 1st mixer.

c. First Mixer

Signals from the rf preselector and multiplier circuits are applied to the first mixer, a field effect transistor (Q1). The injection frequency is below (low side injection) the rf carrier frequency. The mixer heterodynes the two signals to produce the first intermediate frequency (1st i-f) of 11.7 MHz.



d. First Intermediate Frequency (High IF) and Second Mixer

The output from the 1st mixer (Q1) is coupled through a monolithic crystal filter to a common emitter high i-f amplifier circuit (Q5). The crystal filter provides close-in selectivity at alternate and adjacent channels.

The output of the i-f amplifier is coupled to the base of the second mixer (Q6) through a highly selective triple-tuned network consisting of T2, L7 and L8.

The crystal-controlled 2nd oscillator operates below the 1st i-f at 11.245 MHz except in the case where the receiver is tuned near harmonics of this frequency. To avoid interference from these harmonics a crystal which oscillates above the 1st i-f at 12.155 MHz is used.

The 12.155 MHz crystal is 455 kHz above the 11.7 MHz 1st i-f and the 11.245 MHz crystal is 455 kHz below it. The output of the 2nd mixer is the difference between the 2nd local oscillator and the 11.7 MHz i-f. This resulting 2nd i-f frequency is 455 kHz.

e. Second IF

A "Permakay" 2nd IF Filter precedes the second i-f amplifier circuit. The filter sections are permanently sealed in polyesterstyrene and the filter is unconditionally guaranteed for the life of the receiver, provided the seal is not broken and the housing is not tampered with. This filter is the major factor in determining the bandwidth and selectivity of the receiver. It greatly attenuates the signal outside the pre-determined bandpass. Three i-f amplifier stages follow the 455 kHz filter to saturate the limiter.

f. Limiter Stage

The three limiter stages are 455 kHz amplifiers arranged so that an increase in input signal produces no change in the amplitude of the output signal. Because of more than adequate receiver gain, the limiters are in full saturation at all times, that is, with weak or strong signals or noise only.

When a signal is applied to the N-P-N first limiter, the base is driven negative with respect to the emitter when the signal is negative. This places a reverse bias at the emitter-base junction causing the collector current to drop to zero. When the signal is positive, the base-emitter junction becomes forward biased thus increasing the collector current to its maximum value. Thus, the collector current is driven to both cut-off and maximum. Operation of the second limiter is essentially the same except that the signal undergoes a phase reversal in the first limiter and the P-N-P transistor performs the same functions with its input signal of opposite polarity. The output of the limiters is a signal of constant amplitude.

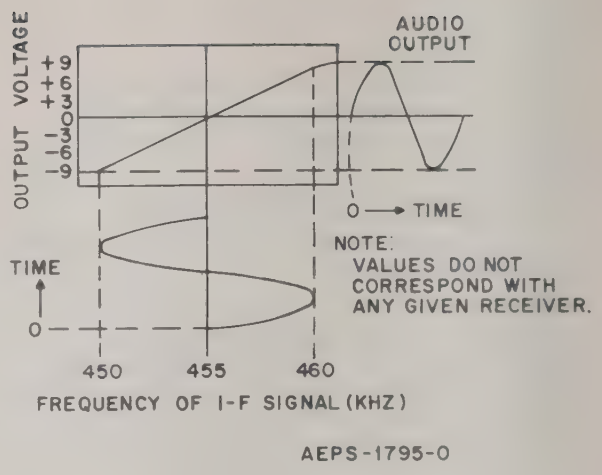


Figure 3.

Typical Discriminator Response

g. Discriminator

The discriminator used is a phase discriminator, that is, the operation is dependent upon a 90° phase shift which occurs at resonance between the primary and secondary voltages of the tuned transformer.

The discriminator recovers the audio from the 455 kHz i-f signal. A typical discriminator response curve is shown in Figure 3.

The i-f signal varies in frequency at the audio rate. This is shown below the curve. The corresponding audio output is drawn to the right of the curve.

An emitter follower (Q309) is used to prevent possible loading of the discriminator by the audio and squelch circuits.

h. Noise-Actuated Squelch Circuit

The purpose of the squelch circuit is to eliminate disturbing noise which would otherwise be heard at the speaker during intervals between received messages.

The noise-actuated squelch circuit consists of a noise limiter (Q345), noise detector (Q346), and dc control stage or audio switch (Q347).

In the absence of a received rf carrier (SQUELCH control at threshold), noise from the

discriminator is amplified by the noise amplifier limiter. This noise voltage is rectified in the form of drawing more or less current in the noise detector stage. More current is drawn when the receiver is fully squelched (SQUELCH control fully clockwise); less current is drawn when the receiver is in the unsquelched condition.

When the noise detector is drawing heavy current, a less positive voltage is developed at the emitter of the detector. This causes a forward bias to be applied to the switching transistor which, in turn, reverse biases the first audio amplifier stage cutting off that stage. Therefore, the following audio stages do not receive signals and the speaker is quiet.

When an on-frequency signal is received, the noise reaching the squelch circuit diminishes so that there is little or no output from the noise detector. As a result, the audio switch is cut off and the audio amplifier is biased normally. Under these conditions, the incoming signals reach the speaker.

i. Tone-Actuated Squelch Circuit in "Private-Line" Tone-Coded Squelch Models

As shipped from the factory, "Private-Line" receivers incorporate a tone actuated "Private-Line" squelch circuit that works in conjunction with the noise actuated carrier squelch circuit. In this mode the "Private-Line" squelch sensitivity is affected by the carrier squelch sensitivity. Thus the "Private-Line" squelch sensitivity is variable with the setting of squelch control. If desired, the radio can be wired so that the "Private-Line" squelch sensitivity is independent of the carrier squelch control. To accomplish this, insert jumper JU702 and remove jumper JU703. In normal operation, the receiver audio is activated only when both of the following conditions occur: (1) an on-frequency rf signal must be received to disable the carrier squelch circuit and (2) the rf signal must be FM modulated with the proper sub-audible tone frequency to activate the "Private-Line" tone-coded squelch decoder circuit.

The "Private-Line" (PL) decoder circuit consists of a low-pass filter network, a high-gain amplifier, an amplifier/clipper, a "Vibrasponder" driver stage, a "Vibrasponder" resonant reed, an output amplifier, a detector, an output switch stage, and a noise gate switch.

The output from the emitter follower is connected to the low-pass filter network, (L751, C752, C753, C754) which passes frequencies below 300 Hz. The low-frequency signals (PL tone) are amplified by Q751 and coupled to the input of the amplifier/clipper Q752. The output of the amplifier/clipper is applied to the "Vibrasponder" driver stage to drive the resonant reed.

The "Vibrasponder" resonant reed is a highly selective, contactless, electro-mechanical device which is permanently tuned and sealed at the factory. The reed is energized only when a tone of the precise frequency appears in the discriminator output. When this occurs, the vibrating reed produces a sinusoidal output which is amplified and detected. The detected output is applied to the output switching transistor (Q756) which provides a dc voltage for biasing the switching transistor (Q347). The noise (carrier) squelch detector (Q346) also provides dc voltage for biasing Q347. If both of the voltages exceed a certain level (approximately 10 V), the audio switching transistor (Q347) base-emitter junction will be back-biased and the first audio amplifier (Q340) will conduct.

The PL low-pass filter is paralleled by a high-pass circuit to prevent erratic operation of the "Vibrasponder" reed because of noise. The high-pass filter passes some higher frequency noise components which tend to drive the amplifier/clipper into limiting. The resulting saturation of Q751 effectively reduces the PL squelch sensitivity.

When the proper tone signal is received and the audio pre-driver stage is turned on, the high-pass path is shorted to ground through the noise switch (Q757). With the high frequency noise removed, the PL squelch sensitivity is at maximum to insure an unsquelched receive condition until the end of the transmission.

Since both a carrier and proper PL tone must be present in the receiver to activate the receiver audio, the carrier squelch control affects the PL sensitivity (with the jumper circuit configuration on radio sets as shipped from the factory). For optimum sensitivity, use the procedure outlined in the INSTALLATION AND OPERATION section of this manual.

j. "Digital Private-Line" Binary-Coded Squelch Models

"Digital Private-Line" binary-coded squelch is a system that utilizes a binary code to unsquelch the radio set. The basic operation of this squelch is described in a separate Motorola instruction section, 68P81106E83. This instruction section together with the schematic diagram provides theory and maintenance information for this type of squelch.

k. Audio Circuit

Audio signals from the discriminator are coupled to the first audio stage through the VOLUME control and a high pass filter. The VOLUME control varies the signal level applied to the base of the first audio amplifier. The filter effectively blocks signals below 300 Hz (on "Private-Line" models, additional filtering is provided to more completely suppress the PL tone) and pass the desired audio range of 300-3000 Hz.

The first audio amplifier is reverse biased when the radio set is squelched. The emitter voltage drops below the base voltage to produce the reverse bias condition. In the normal receive condition, the first audio amplifier is forward biased and the output signals are applied to the driver. The drivers are connected in an emitter coupled phase splitter configuration. The capacitor in the base of one driver transistor provides the 6 dB per octave de-emphasis characteristic from 300 to 3000 Hz. As the frequency of the signal increases, the impedance across the capacitor decreases and the resultant signal amplitude decreases. The audio output from the drivers is transformer coupled to push-pull output amplifiers. The output stage provides a 5-watt output to a 3-ohm speaker with less than 5% distortion. Response is within +2, -8 dB of the 6 dB per octave de-emphasis characteristic from 300 to 3000 Hz.

3. TRANSMITTER

a. General

This solid-state transmitter is directly frequency-modulated for crystal controlled operation in the 450-512 MHz range. It consists of an oscillator-modulator, several amplification and frequency multiplication stages and selective filtering to process a carrier signal which is 27 times the fundamental crystal frequency. The Transmitter Block Diagram (Figure 4) shows the stage-by-stage signal flow and operating frequencies.

b. Microphone and Preamplifier Circuit

The Motorola dynamic microphone contains a transistorized preamplifier. The microphone cartridge and preamplifier acts as a variable voltage generator producing an output voltage which varies with both frequency and intensity as the sound waves strike the diaphragm.

c. Deviation Limiting Circuit

(1) A-Suffix Main Board Models

The output waveform from the microphone is connected to the deviation limiting circuit. The deviation limiting circuit consists of components for pre-emphasizing, amplifying and limiting the input waveform.

C196, R196, C191, and the input impedance of the IDC Amplifier comprise an audio shaping network which yields a 6 dB per octave pre-emphasis response below 3 kHz and a flat response above 3 kHz. After pre-emphasis, the audio signal is amplified by Q101 and Q102. Negative feedback (R186 and R187) is used to maintain constant gain and low audio distortion. Amplitude peaks are clipped when Q102 is driven to saturation (fully on) or cut-off (fully off). The peak-to-peak amplitude is limited to 9.1 volts by Zener diode CR181.

The pre-emphasized, amplified and clipped microphone audio passes through the splatter filter (L180, C188, C194, and C195) to the base of the emitter follower (Q103). (The PL tone is injected at this point on PL models.) The emitter follower isolates the modulator load from the splatter filter thus insuring proper splatter filter response. An IDC adjustment potentiometer is provided for each oscillator (R101, R102, R103, R104). It is necessary to set the deviation for each channel in a direct FM system because the modulator sensitivity is related to the individual oscillator characteristics.

(2) B-Suffix Main Board Models

Refer to exciter schematic diagram EEPS-4699-F. Microphone audio is applied to the deviation limiting circuit, which provides pre-emphasis, amplification, and audio limiting.

Coupling capacitor C182 and the input resistance of the audio amplifier stage (Q100) provide 6 dB per octave pre-emphasis.

The audio signal from the microphone is amplified by Q100 and is applied to the "IDC" limiter. The IDC limiter consists of complementary-connected transistors Q101 and Q102, and their associated components. Capacitor C185, with the base and emitter resistances of Q101, and C186, with the base and emitter resistances of Q102, form a high-pass filter with a cut-off frequency of about 200 Hz. The single-ended output from the collectors of Q101 and Q102 is

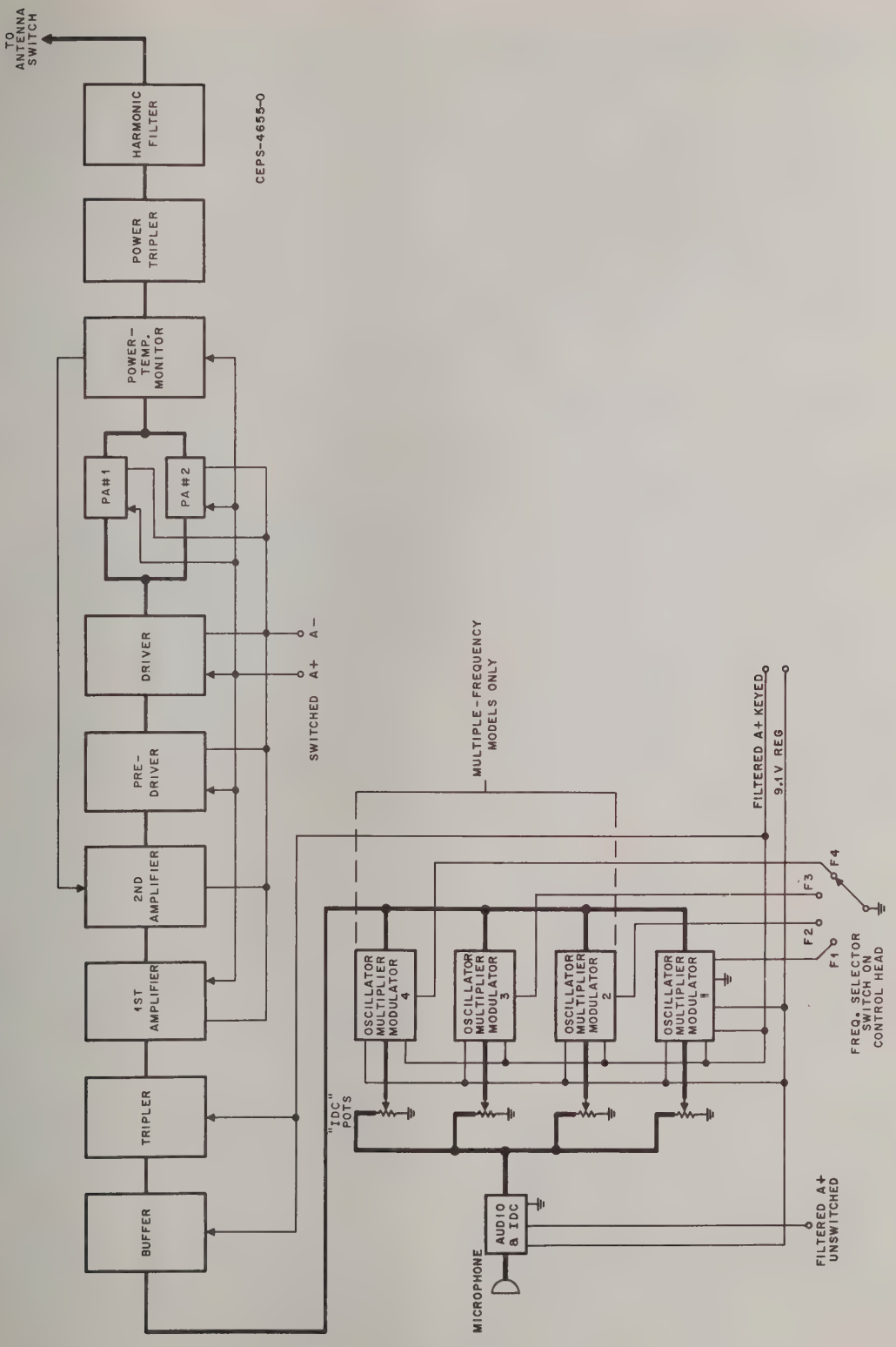


Figure 4. Transmitter Block Diagram

applied to the input of emitter follower Q103. Emitter-to-base and collector-to-base feedback paths are provided to ensure a symmetrical input waveform at the input of the emitter follower.

The limited audio signal passes through splatter filter L180 and C188 to the base of Q103. The PL tone is also applied to the base of Q103 in PL model radio sets. The emitter follower isolates the modulator load from the splatter filter to ensure proper splatter filter response. An IDC adjustment potentiometer is provided for each oscillator. It is necessary to set the deviation for each channel in a direct FM system because the modulator sensitivity is related to the individual oscillator characteristics.

d. Modulator-Oscillator-Multiplier Stage

The combination modulator-oscillator-multiplier stage generates a modulated rf signal at three times the fundamental crystal frequency. The direct frequency modulator consists of the parallel combination of a varactor and warping coil connected in series with the crystal. A change in capacitance seen at the crystal terminals will cause the crystal to vary its resonant frequency in proportion to the capacitance change. The audio voltage from the audio and IDC circuitry is applied to the varactor to cause a change in capacitance; this variation in turn causes the frequency to change at the same audio rate. The double-tuned circuit, L102 and L103 at the output of the oscillator transistor(s), tunes to the desired third harmonic of the crystal.

NOTE

Because the frequency adjustment coils (L101, L107, L108, L109) and the modulator circuitry are combined, THE TRANSMITTER FREQUENCY MUST BE PROPERLY ADJUSTED BEFORE SETTING THE TRANSMITTER DEVIATION WITH THE "IDC" CONTROL. Refer to the transmitter alignment procedure for details.

e. Multiplier and Amplifier

From the modulator, the rf signal is amplified by Q105 and applied to Q106, which is a class C multiplier that triples the signal frequency. The tripler output is next amplified by Q107. All of the rf circuitry up to this point is contained in the exciter. The rf output frequency of the exciter is 150.0 to 170.7 MHz, with a nominal power output of 500 milliwatts.

f. Power Amplifier

The power amplifier (Q108, Q109 and Q110) consists of three class C amplifiers and two final amplifiers (Q111, Q112) arranged in a push-pull configuration. The stages are coupled by low Q broadband capacitive matching networks such that only two tuning elements (C102, C103) are required in the entire power amplifier circuit. The power output from the amplifier chain is nominally 50 watts at approximately 150 MHz.

g. Power Tripler

The 150 MHz output from the power amplifier is fed through a broadband matching network to the power varactor CR640. The non-linear characteristic of the varactor causes the rf input signal to be frequency doubled (to approximately 300 MHz) The 300 MHz signal is then passed through the non-linear varactor a second time during which the 300 MHz signal and the 150 MHz input signal are heterodyned to produce a 450-512 MHz signal, the desired carrier frequency. The power tripler output is coupled through the output matching network (L642, C104, L643, and C642) to the bandpass harmonic filter and the antenna switch.

h. Power-Temperature Monitor

A series regulator (Q113) is the collector feed of the 2nd amplifier and it protects against harmful conditions which cause power amplifier overdissipation such as antenna mismatch, high battery voltage or excessively high temperatures.

A directional coupler is used to sense forward power levels. By sensing the forward power, the output level can be stabilized within safe, controlled levels of transistor dissipation. The forward power level is detected by CR670 and applied to trigger amplifier Q115. The trigger level of Q115 is determined by potentiometer R105. Once Q115 is triggered, dc amplifiers Q116 and Q117 are turned on. Normally Q118 and Q113 are saturated. However, when Q117 turns on, Q118 and Q113 drop out of saturation, thus reducing the dc voltage supplied to rf amplifier Q108. RF power output from Q108 is reduced when its dc supply voltage falls. RF drive to the power output stages and, consequently, rf power output are thereby reduced.

Thermistor RT670 monitors the varactor temperature and reduces rf drive to the power tripler to prevent varactor overdissipation under conditions of high ambient temperatures and excessively long transmitter keying. Under these

conditions, communications can be maintained at a reduced power level. R685, R686 and RT670 base bias Q115 at high temperatures thus causing a reduced A+ voltage to the 2nd amplifier. Short circuit protection for the 2nd amplifier supply line is achieved by current limiting Q118 with CR673, CR674 and R689.

i. "Private-Line" Tone Generator

This tone generator consists of a transistorized two-stage oscillator and "reverse burst" switching circuit. The frequency determining element of the oscillator is a Motorola "Vibrasender" resonant reed (an electro-mechanical equivalent of a parallel-tuned high Q tank circuit). The oscillator operates continuously when the radio set is turned on. The oscillator output is amplified by Q706 and Q707 and is then injected into the transmitter audio - IDC circuit.

The oscillator circuit is made up of Q704, Q705, the "Vibrasender" resonant reed and the bias circuitry. The oscillator tone output is taken from the collector of Q705 or from resistor R724 in the emitter circuit of Q705. The selection of these two paths is determined by diodes CR710 and CR711. When the transmitter is keyed, the push-to-talk lead is connected to the grounded battery terminal. The diode bridge (comprised of CR701, CR702, CR703 and CR704) causes Q701 to turn on. When this happens, CR710 becomes reverse biased and CR709 is forward biased through R728, R730 and R731. The tone oscillator output is now taken from R724. When the push-to-talk button is released, Q701 is turned off and CR710 is now forward biased through R725, and R729. Diode CR709 becomes reverse biased and the tone output is now taken from the collector of Q705. The 180° phase shift between the two tone paths gives a "reverse burst" of tone just after the push-to-talk button is released. This tone prevents "squelch tail" from occurring in the receiver by quickly damping the "Vibrasponder" resonant reed. Even though the push-to-talk button is released, the transmitter remains "on" for approximately 150 milliseconds so that the "reverse burst" of tone may be transmitted. This delay is accomplished by Q702 and Q703 which comprise the "reverse burst" switching circuitry. When the transmitter is keyed, Q701 and Q703 are immediately turned on. Q703 supplies current to the transmit/receive relay. When the push-to-talk button is released, Q701 and Q702 are turned off but Q702 turns on again after capacitor C701 is discharged through R705. It should be noted that during the discharge time (approximately 150 milliseconds) Q702 is off and Q703 is on. Finally as Q702 is turned on, Q703 is turned off. This action removes the voltage from the relay which turns off the transmitter.

j. "Digital Private-Line" Encoder

The encoder is contained in an integrated circuit which generates a 23-bit code word during the transmit cycle and a turn-off code for approximately 180 milliseconds after PTT. These signals are applied to the transmitter audio-IDC circuit. For complete description refer to the schematic diagram and separate instruction section 68P81106E83.

4. RECEIVER PREAMPLIFIER (OPTIONAL)

The preamplifier is a single stage grounded gate FET (field effect transistor) rf amplifier which connects between the antenna switch and receiver rf deck. It improves receiver sensitivity 6 dB from the specified receiver 20 dB quieting sensitivity of .5 microvolt.

The signal from the antenna is coupled directly into the input tuned-line of the preamplifier. This tuned-line passes the desired signal and matches the relatively low FET input impedance to the 50-ohm input line. The signal is capacitively coupled to the source terminal of the FET where it is amplified and then capacitively coupled to the output tuned-line. The output tuned-line is a high Q tank circuit. It passes the desired signal and matches the relatively high FET output impedance to the 50-ohm output line.

5. GROUND REVERSING KIT (OPTIONAL)

a. Description

These kits, available on special request adapt "Mocom • 70" radio sets to vehicles with either negative or positive ground electrical systems.

The unit consists of a converter circuit mounted in a compact housing with a plug for insertion into a mating receptacle located in the radio set. Rotating the unit 180° and reinserting it into the receptacle adapts the radio set for the opposite input polarity. The two input polarities are marked on the unit at opposite ends and an arrow on the polarity plug plate identifies the orientation of the unit.

b. General Circuit Operation
(Refer to Schematic Diagram)

When the unit is inserted in the power receptacle in the negative ground position, input polarity to the converter circuit is such that it does not operate. Wiring of the unit connects the dc input directly to the radio set with the proper polarity.

When the ground reversing kit is positioned for positive ground operation, a multivibrator switching circuit feeds the input current into the primary side of a toroid transformer. To produce 12 volts referenced to the chassis, A+ with respect to ground, the output from the transformer secondary (approximately 15 volts) is rectified, filtered and referenced to the battery positive terminal, which is the radio chassis. A limiter circuit in the output of the unit prevents damage to the switching transistors under a shorted output condition.

DC starting is provided by resistor R202, which feeds current from the positive input through the base-drive windings of the transformer to the base of the switching transistors. Reverse polarity protection is provided by series diode CR202, in the primary circuit negative-return lead.

c. Starting and Running

When voltage is applied to the converter, assume that Q201 conducts more than the other switching transistor because of a small imbalance in the circuit. The resulting increase in voltage across the primary of the transformer induces a voltage in the feedback winding of a polarity that will cause transistor Q201 to be driven into saturation and Q202 to be reverse biased and driven into cutoff. As the transformer saturates, causing no change in the flux density, the drive to the base of Q201 is reduced and the collector current begins to decrease. This causes a change in the flux in the opposite direction that drives Q201 into cutoff and forward biases Q202, turning it on. Q202 then operates as Q201 did in the initial half cycle.

d. Output Circuit

The output limiter circuit uses Q204 as a short-circuit detector to control the base drive of a saturated switching transistor (Q203) connected in series with the positive output lead. If the output is short circuited, the output voltage falls and removes the drive voltage to the short-circuit detector (Q204). As Q204 turns off, the base drive to Q203 is removed forcing it into cutoff. This causes the 680-ohm resistor (R205), connected from the collector to the emitter of Q203, to appear as the load so that the converter operates correctly with a 680-ohm load instead of a short circuit load.

e. Conversion of Negative Ground Only Radio Sets to Positive or Negative Ground Operation

Remove existing plug P201 (TLN8427A Negative Ground Kit) from the radio and replace it with the TLN8482A Ground Reversing Kit. Insert this plug-in unit so that the arrow on the polarity plug plate points to the same ground polarity on the kit as that of the vehicle electrical system.

6. TIME-OUT TIMER (OPTIONAL)
(Refer to Schematic Diagram)

The time-out timer circuitry (mounted on the polarity plug plate) is used to turn off the transmitter and activate the receiver audio to generate an alert tone if the radio set is keyed continuously for more than one minute.

Once the timer has timed out, it may be reset for another minute by simply unkeying and then keying the transmitter.

When the radio set is in the receive condition, keyed A+ with respect to ground is removed, therefore, diode CR251 is reverse biased and transistor Q251 is saturated by the bias applied to its base via resistors R253 and R254. When the transmitter is keyed, the keyed A+ with respect to ground forward biases diode CR251 and reverse biases the base emitter junction of Q251, turning it off. With Q251 cut-off, capacitor C251 starts to discharge through resistor R255. During this discharge time the emitter of transistor Q252 is held at approximately 2.7 volts by the combination of resistors R256 and R257. This emitter voltage holds Q252 at cutoff. After a one minute period, the voltage across capacitor C251 drops to approximately 1.6 volts. At this time, diode CR252 becomes forward biased turning on transistor Q252 which supplies sufficient gate current to fire the silicon controlled rectifier (SCR) SCR251. When the SCR conducts, the base-collector junction of transistor Q253, which serves as a diode, becomes forward biased causing transistor Q250 to shut off. On radio sets equipped with a time-out timer, Q250, normally acts as an emitter follower and is the A+ voltage source for the transmitter oscillator-modulator. Thus, when Q250 is shut off, the transmitter is shut off.

When the transmit-receive relay opens, transmitter keyed A+/GND drops to zero thereby permitting SCR251 to reset.

When the SCR conducts, the unijunction transistor (Q255) oscillates at an audio frequency. The output from oscillator Q255 is fed through capacitor C255 and R252 to the audio drivers in the receiver as the alert tone. The amplitude of the alert tone may be changed by changing the value of R252 (at no time should R252 be less than 47K ohms). The table on the schematic diagram shows the amplitude variations in speaker output, for different selected values of R252. Biasing voltages for these stages are supplied via resistor R251 and diode CR253 when the keyed A+ with respect to ground is applied.

7. AUTOMATIC PILOT LIGHT DIMMER CIRCUIT

(Refer to applicable Schematic Diagram)

The pilot light dimmer circuit automatically controls the brilliance of the green (receive) pilot light mounted on the control head. In bright daylight, the light glows brightest to insure visibility. The light becomes progressively dimmer to reduce excessive glare as daylight changes to darkness. External illumination is sampled through a window in the lower portion of the control head and acts upon a light detecting resistor which is mounted behind the window.

When the radio is turned on, transistor Q501 conducts. Its collector current flows through the green pilot light, DS501. The light detecting resistor (LDR) R513, which is part of the base biasing network for Q501, controls the base current flowing into the transistor. Consequently, the current passing through the green pilot light is inversely related to the resistance of R513 (LDR).

The resistance of the LDR is controlled by the amount of light striking it (the resistance decreases as the light intensity increases and vice versa). During daylight operation (LDR resistance low), the collector current of Q501 is high and the light glows brightly. During night time operation (LDR resistance high), the collector current of Q501 is low and the light glows dimly.

The diode bridge (comprised of CR501, CR502, CR503, and CR504) is a polarity switching network which permits dimmer circuit operation in both positive and negative ground systems.

MAINTENANCE

1. RECOMMENDED TEST EQUIPMENT

All of the recommended test equipment for aligning and testing the radio set is listed in the TABLE OF RECOMMENDED TEST EQUIPMENT. The listed items or their equivalent should be used.

2. TRANSMITTER SERVICING

a. Alignment Procedure

Instructions for aligning the transmitter are provided in the Transmitter Alignment Procedure of this manual. Refer to these instructions for all information pertaining to transmitter tuning.

b. Metering the Transmitter

A 12-pin metering receptacle for connecting a Motorola S1056B to S1059B Series Portable Test Set is located in the exciter circuit on the main radio board. A Motorola Model SKN6012B Metering Cable must be used to connect the portable test set to the metering socket. Typical meter readings are given in the Transmitter Alignment Procedure. If meter readings differ greatly from those in the table, check the transmitter for defective components or improper alignment.

c. Power Output

Connect a wattmeter at the antenna receptacle on the front panel of the radio set and take a power reading. If rated power output is not obtained (25 watts) proceed with meter readings.

d. Meter Readings

Connect the portable test set to the transmitter metering socket and set the function selector switch of the test set to the XMTR position. Take readings and compare them with the values tabulated in the Transmitter Alignment Procedure, or preferably, compare them with the set of readings taken the last time the transmitter was serviced.

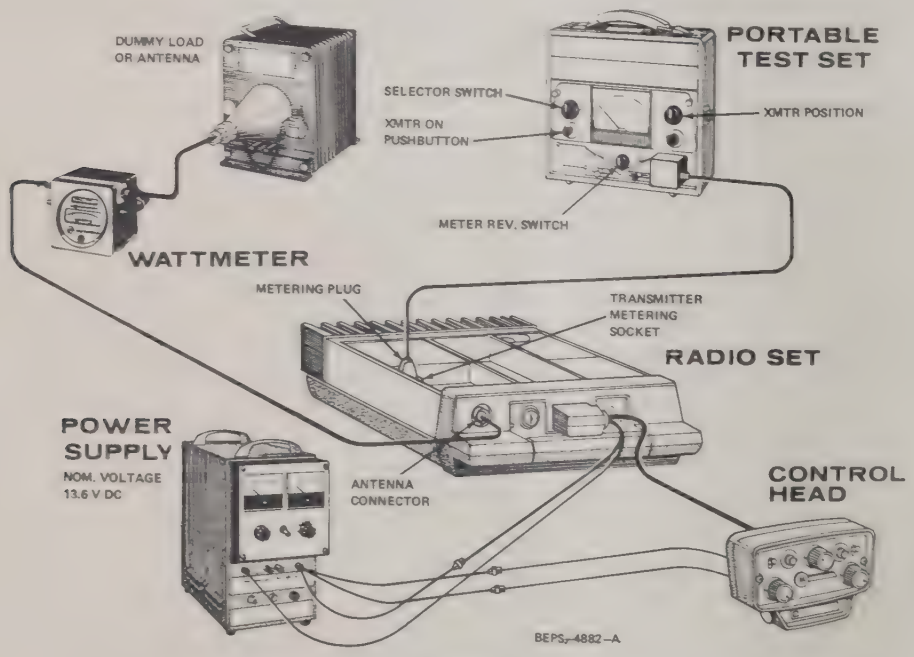


Figure 5.
Exciter and Power Amplifier Test Set-Up

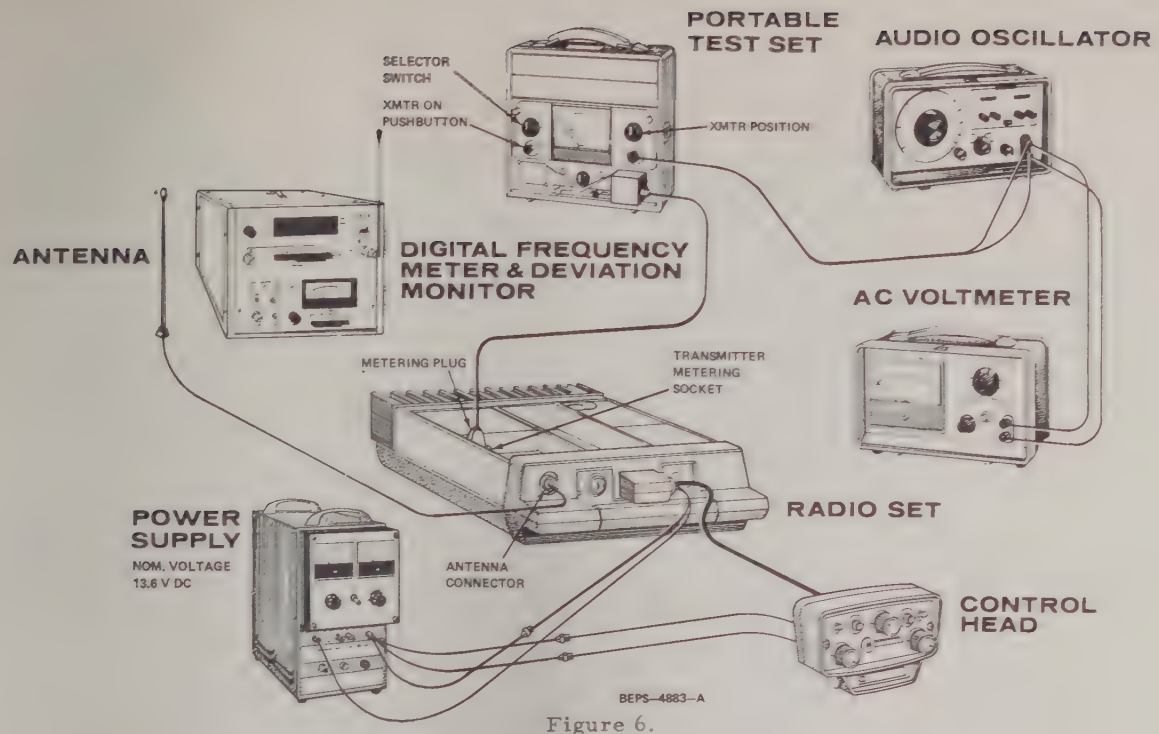


Figure 6.
Frequency, Deviation and Audio
Sensitivity Test Set-Up

e. Troubleshooting the Transmitter

If exciter meter readings are abnormal, the malfunction can be isolated by checking the appropriate stages for proper dc signal voltages. DC readings should be made with either a high impedance voltmeter or a VOM as noted on the schematic diagram, and compared to the readings on the schematic diagram or previous voltage data on the unit. It should be noted that the class C stages Q106, Q110, Q111 and Q112 will show reverse bias on the emitter-base junction. This is normal, due to the self-bias generated by the transmitter when driver is present. Consequently, this can be used as an indication of drive to a particular stage.

The ac signal readings given in TABLE III may be used as a guide to isolating a defective stage. Also, typical transmitter audio and rf waveforms are shown on the schematic. An rf probe and high impedance dc voltmeter can be used for the rf readings. The audio stages will require a sensitive ac voltmeter.

Voltage and resistance checks of the suspected stage in the exciter or power amplifier section should isolate the defective component.

If all meter readings and rf voltages are normal and there is no power output, check all connectors on the harmonic filter and antenna switch. If necessary, remove the power tripler in the manner illustrated in Figure 12.

Check the varactor diode with a volt-ohm meter to measure the dc resistance in both directions (an electronic voltmeter will not give valid readings in this application). A low impedance should be read in one direction and 5.6k in the other. If 5.6k is measured in both directions, the diode is open. Remove diode as shown in Figure 15 and replace. If a low impedance is read in both directions, remove the diode and check it by itself. If the diode tests good, check all parts in the matching networks for short circuits.

If the ohmmeter readings are correct, use a high impedance dc voltmeter to measure the voltage from diode to ground when the transmitter is keyed. A voltage of approximately -20 V dc should be read. If no voltage is measured, check the input cable and matching network for open circuits or loose connections.

f. Frequency and Audio Sensitivity

Check transmitter frequency and modulation sensitivity. No more than 140 mV rms and no less than 70 mV rms of 1000 Hz audio signal applied (through a capacitor) at the microphone receptacle should be required to produce 3.0 kHz deviation. If the transmitter cannot be "warped" to the proper frequency, check the regulator

voltage (9.1 V dc). Replace the resonator, varactor diode, or other oscillator components if necessary.

g. "Private-Line" Encoder

If transmitter deviation with PL tone applied is improper, check the tone oscillator and tone amplifier circuits. The typical ac signal levels, given in TABLE I, were measured with a Motorola Transistorized AC Voltmeter. Signal levels may vary widely depending upon the frequency of the "Vibrasender" Resonant Reed.

The phase of the signal at the tone generator output should reverse when the transmitter is keyed and revert to the original condition immediately when unkeyed. The "Vibrasender" Resonant Reed can be checked quickly by plugging it into a Motorola SLN6221A "Private-Line" Tone Generator. If a tone output is generated, the reed is good. Make dc voltage checks and resistance checks to isolate the defective part.

If "squelch tail" noise bursts are heard in listening receivers, check voltages in the "reverse burst" switch circuit of the transmitting station. DC voltages given on the schematic are for the transmitter keyed condition. Figure 7 shows the important transient waveforms which should be seen in the "reverse burst" circuitry when the transmitter is unkeyed.

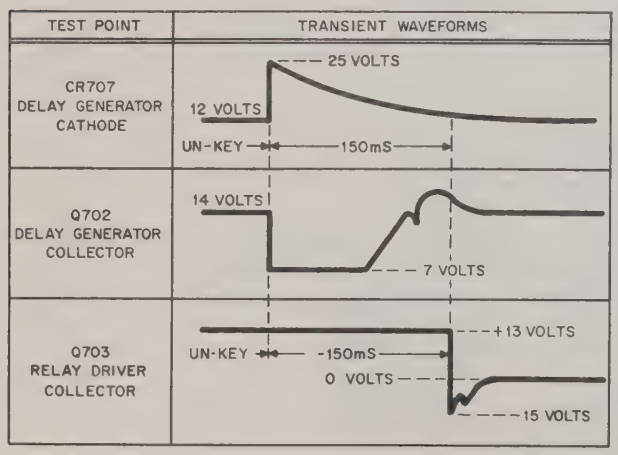


Figure 7.
Transients Appearing in "Private-Line" Delay Circuit After the Transmitter is Unkeyed

h. "Digital Private-Line" Code Generation

If transmitter deviation with "Digital Private-Line" binary signals applied is improper, refer to separate Motorola instruction section 68P81106E83 for information on setting deviation.

3. RECEIVER SERVICING

a. Alignment Procedure

Instructions for aligning the receiver are provided in the Receiver Alignment Procedure of this manual. Refer to these instructions for all information pertaining to receiver tuning.

b. Metering the Receiver

A 12-pin metering receptacle for connecting a Motorola S1056B to S1059B Series Portable Test Set is located near the discriminator transformer on the main radio board. A Motorola Model SKN6012B Metering Cable must be used to connect the portable test set to metering socket.

c. Receiver Sensitivity

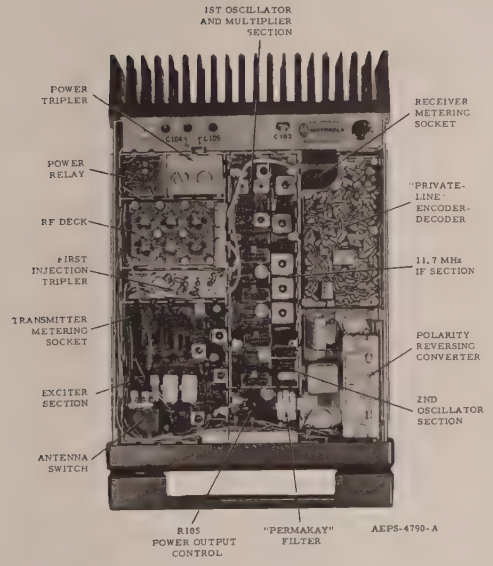
The sensitivity measurement is a relatively simple means for making a very comprehensive check on receiver overall gain distribution and general operating performance. The sensitivity check should be among the first measurements made when a receiver malfunction is suspected.

Receiver sensitivity can be determined by using either the EIA-SINAD method or the 20 dB quieting method. The SINAD method is certainly the better of the two since the use of a modulated carrier gives a check on receiver bandwidth and audio power output; two performance characteristics which the quieting method by and large ignores. Quieting sensitivity, however, is by far the simpler measurement and, consequently, is the measurement generally performed in the field. The procedures for both measurements are given here.

(1) 20 dB Quieting Sensitivity: Specification = 0.50 uV or less (0.25 uV or less with preamplifier)

The 20 dB quieting sensitivity of a receiver is the minimum value of unmodulated rf generator voltage which will reduce the receiver noise output by 20 dB (1/10th of the initial noise voltage).

To conduct the test, an rf signal generator must be connected to the receiver antenna input and the receiver audio output terminated in its proper load (3- to 4-ohms) with means provided to measure the audio output level. (Either an audio vtvm or a Motorola S1056B to S1059B Series Test Set may be used.)



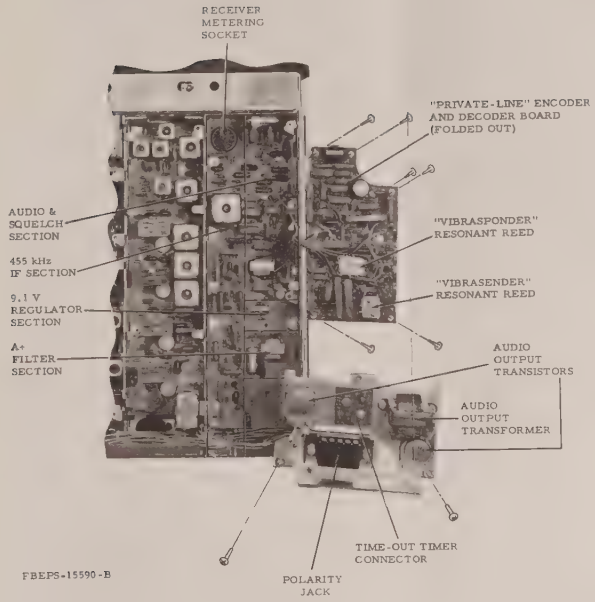


Figure 8.
Radio Set Location Detail

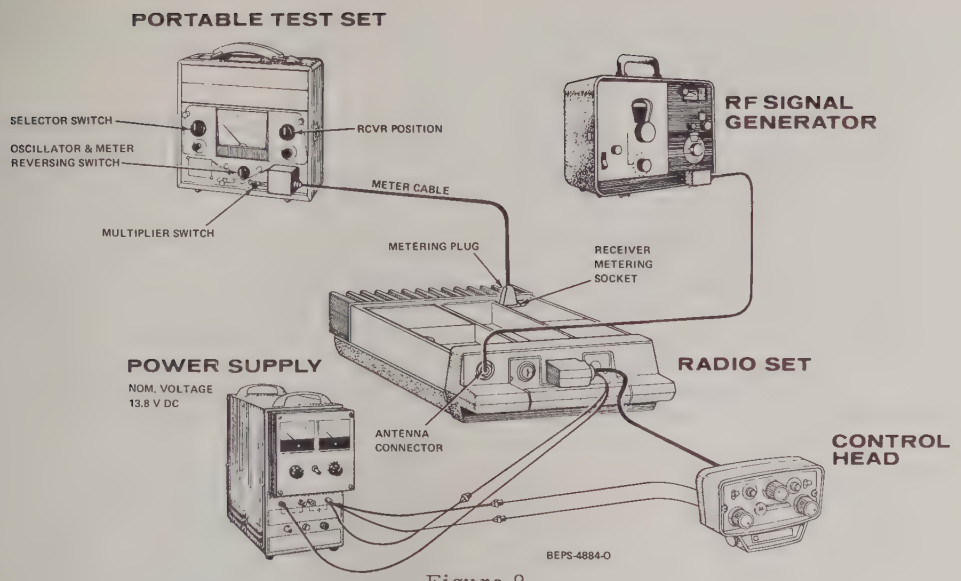


Figure 9.
RF and IF Test Set-Up

With the signal generator initially turned off the carrier frequency, adjust the receiver audio volume control, located on the radio set control head, for 1.0-volt rms audio noise output. (Switch position 11 on the test set.) Note that the squelch control should be turned fully counterclockwise (receiver unsquelched) for this test. On "Private-Line" or "Digital Private-Line" squelch models, the radio must be out of the PL mode.

With the signal generator initially adjusted for a substantial rf input to the receiver (1000 uV), set the generator frequency on the carrier frequency and carefully adjust for discriminator "0" (switch position 4 on the Motorola test set).

The signal generator output is then reduced until the audio output noise level increases to 0.1 V rms. This generator input level is the receiver 20 dB quieting sensitivity.

(2) 12 dB Sinad Receiver Sensitivity:
Specification = 0.35 uV or less (.18 uV or less with preamplifier)

The EIA definition for sensitivity of a receiver is the minimum value of the modulated rf generator voltage which will produce at least 50% of the receiver's rated audio power output with a (signal + noise + distortion) to (noise + distortion) ratio (SINAD radio) of 12 dB.

To conduct the test, an rf signal generator frequency modulated with 1000 Hz at ±3.0 kHz deviation, must be connected to the receiver antenna input and the receiver audio output terminated in its proper load (3 to 4 ohms) with means provided to measure audio output level and to "eliminate" the 1000-Hz signal.

The most convenient elimination device is a total harmonic audio distortion analyzer, which is also used as the output level indicator; however, any other filter device having an attenuation of at least 40 dB at 1000 Hz and effectively 0 dB attenuation below 900 Hz and above 1100 Hz (up to 3000 Hz or more) can be used in conjunction with a very high impedance audio voltmeter.

The Motorola Model S1067B Audio Oscillator can be used as a band elimination filter and, when used with an audio voltmeter, provides a convenient means for making this measurement.

With the signal generator initially adjusted for a substantial rf input to the receiver (1000 uV), the generator frequency is carefully adjusted for discriminator "0" (switch position 4 on the Motorola Portable Test Set) and the receiver audio VOLUME control, located on the radio set control head, adjusted to provide an indication of the 5 watts rated audio power output (4 volts across 3-ohm load or 4.5 volts across 4-ohm load). Note that the SQUELCH control on the

radio set control head should be turned fully counterclockwise (receiver unsquelched) for this test. On "Private-Line" or "Digital Private-Line" squelch models, the radio must be out of the PL mode.

The signal generator output is then reduced to a low level (. 35 uV) and the audio output level noted. The 1000 Hz elimination filter is switched into the circuit and the level difference observed. If the difference is 12 dB (level reduced to one-quarter of the previous voltage) this generator input level is the receiver sensitivity. If the difference is either more or less than 12 dB, the generator attenuator must be adjusted slightly until 12 dB is reached and the new attenuator setting is the sensitivity figure. Should the receiver audio output fall to less than 2. 5 watts, with the elimination filter switched out of the circuit, as a result of the test, the generator output must be increased until 2. 5 watts is reached and this setting is the receiver sensitivity, even though the SINAD will be greater than 12 dB.

d. Meter Readings

Connect the portable test set to the receiver metering socket and set the function selector switch to the RCVR position. Check the meter readings (with no carrier signal) and compare with the typical readings given in Figure 10.

FIGURE 10.
TYPICAL RECEIVER METER READINGS
WITH NO CARRIER SIGNAL

Selector Switch Position	Typical Meter Readings in uA	Stage
1	0	Base of 3rd 455 kHz amplifier
3	18	Base of Injection Tripler
4	0	Discriminator Secondary
5	25	Discriminator Primary
6	18	1st Oscillator Activity

Set the signal generator on carrier frequency and set the level for a 10-microamp reading in meter position 1. If more than 10. 0 uV (5. 0 uV with preamp) of carrier signal is required for a 10 uA reading on meter position 1, the receiver gain is low. Check for low mixer injection voltages (paragraph e) and improper receiver gain distribution (paragraph g).

A low meter reading in positions 3 or 6 indicates that the 1st mixer injection is probably low. Refer to paragraph e.

A low meter position 5 reading indicates that the 455 kHz amplifier strip is not operating correctly. Refer to paragraph h.

e. Injection Voltages

With no signal into the receiver, measure the rf voltage on the base of the second mixer (Q6). This voltage should be between 40 and 80 mV.

The best method of determining whether or not the 1st mixer injection signal is adequate is to measure the change in mixer drain-to-source dc current when the resonator is removed. This current is proportional to the voltage drop across R1. Consequently, injection level can be determined by measuring the voltage drop across R1 with a sensitive dc multimeter. With the resonator removed, the typical voltage drop across R1 should be 0. 10 V dc. Insertion of the resonator should increase this voltage by at least 0. 02 volts.

If either injection voltage is low, check the corresponding oscillator for poor solder connections or defective components. Usually a check of dc voltages in the faulty circuit will pinpoint the source of trouble.

f. Preamplifier Servicing (When Optional Preamplifier is Used)

If a preamplifier malfunction is suspected, the preamplifier should be bypassed and basic receiver operation checked by itself. This is accomplished by disconnecting the rf input plug from the preamplifier and connecting it directly to the rf deck. Connected in this manner, the receiver should meet all specifications and mesurements as described for the receiver without a preamplifier. If the receiver is operating normally, remove and repair the preamplifier.

Preamplifier gain can be most easily checked in the following manner using an rf signal generator and a Motorola test set. Set the signal generator on carrier frequency and measure the input level required to produce a reading of 10 uA on meter position 1. Next bypass the preamplifier as described above, retune L1 on the rf deck for maximum indication on meter position 1, and again measure the signal level required to produce 10 uA on meter 1. The difference between the two rf

input levels is equal to the gain of the preamplifier and should be greater than 6 dB and less than 12 dB.

EXAMPLE:

RF Input for 10 uA on Mtr 1 with Preamp	= -103 dBm (1.6 uV)
RF Input for 10 uA on Mtr 1 without Preamp	= - 96 dBm (3.5 uV)
Preamp Gain	= 7 dB

To remove the preamplifier for servicing, disconnect the input and output rf cables, unsolder the brown-red A+ lead, and remove the two screws which fasten the preamplifier to its mounting bracket.

g. Receiver Gain Distribution + Low Level RF and IF Stages

The simplest method for checking the gain distribution of a receiver is to apply an on-channel rf voltage to the antenna connector while monitoring a selected point in the receiver with an rf voltmeter. The amount of signal necessary to produce a specific reading on the voltmeter gives an indication of the total gain between the antenna connector and the point being monitored. The amount of signal required to produce this reading can then be compared with the values given in TABLE IV and TABLE V. Any significant difference between measured and tabulated values indicates that some circuit between the antenna and the point being monitored is not operating correctly. The faulty circuit can usually be isolated after monitoring several points, whereupon a visual inspection of soldered connectors or a dc voltage check will pinpoint the problem area.

h. High Level 455 kHz Stages

The last three 455 kHz stages should limit receiver noise when no carrier signal is present. Some typical rms noise voltages on the three limiter stages are given in TABLE VI. (All voltages were measured with a Motorola dc multimeter using the rf probe and are referenced to chassis ground.)

The recovered audio noise voltage (as measured at the collector of Q307 with an audio vtvm) should be 1.5 V rms. The corresponding audio voltage at the emitter of Q309 (the emitter follower) should measure around 0.53 V rms.

These ac and rf voltage measurements coupled with the dc voltages listed on the schematic should make troubleshooting this section of the receiver relatively simple. It is possible for the voltage on the base of the 1st 455 kHz limiter (Q304) to be much lower than indicated and still maintain the correct voltage levels at the remaining points. This is an indication of loss of gain in the lower level stages (refer to paragraph g.).

i. Receiver Audio Circuit

Checking the receiver audio section can be done by measuring noise voltages only (i.e., no carrier signal). Set the VOLUME control to maximum and the SQUELCH control fully counter-clockwise (unsquelched). On "Private-Line" tone-coded squelch models, disable PL operation.

Connect an ac voltmeter across the speaker and measure the noise output. At least 3.0 V rms of noise should be measured. (This should correlate to over 5 watts or 4.0 volts of audio output when the unit is receiving a carrier with the standard test modulation.) If the audio output is low, measure the noise voltages at the individual stages to isolate the problem. Typical values of audio noise voltage measured with the Motorola AC Voltmeter are given in TABLE VII.

j. Carrier Squelch Circuit

Remove the carrier signal from the antenna input to the unit. If a "Private-Line" tone-coded squelch model is being checked, disable PL operation (checks for "Private-Line" tone-coded squelch circuits are given in the "Private-Line" section). On all sets, set the SQUELCH control fully clockwise to fully squelch the receiver. Typical meter readings are given in TABLE VIII.

Check the dc voltages at the base and emitter of the 1st audio amplifier Q340. Whether this transistor is forward or reverse biased determines the squelch condition of the receiver. When sufficient noise is present, and the radio is fully squelched, as with no carrier, the voltage applied to the emitter of Q340 should be approximately 8.1 volts dc. The voltage should be increased to 10.0 volts dc to unsquelch the radio circuit.

A properly operating squelch circuit should meet the following sensitivity specifications.

(1) Squelch threshold sensitivity: 0.25 uV (0.15 uV with preamplifier) or less. With no signal input, set the SQUELCH control so the noise just quiets (squelch threshold). On "Private-Line" tone-coded squelch models, take the radio out of the PL mode.

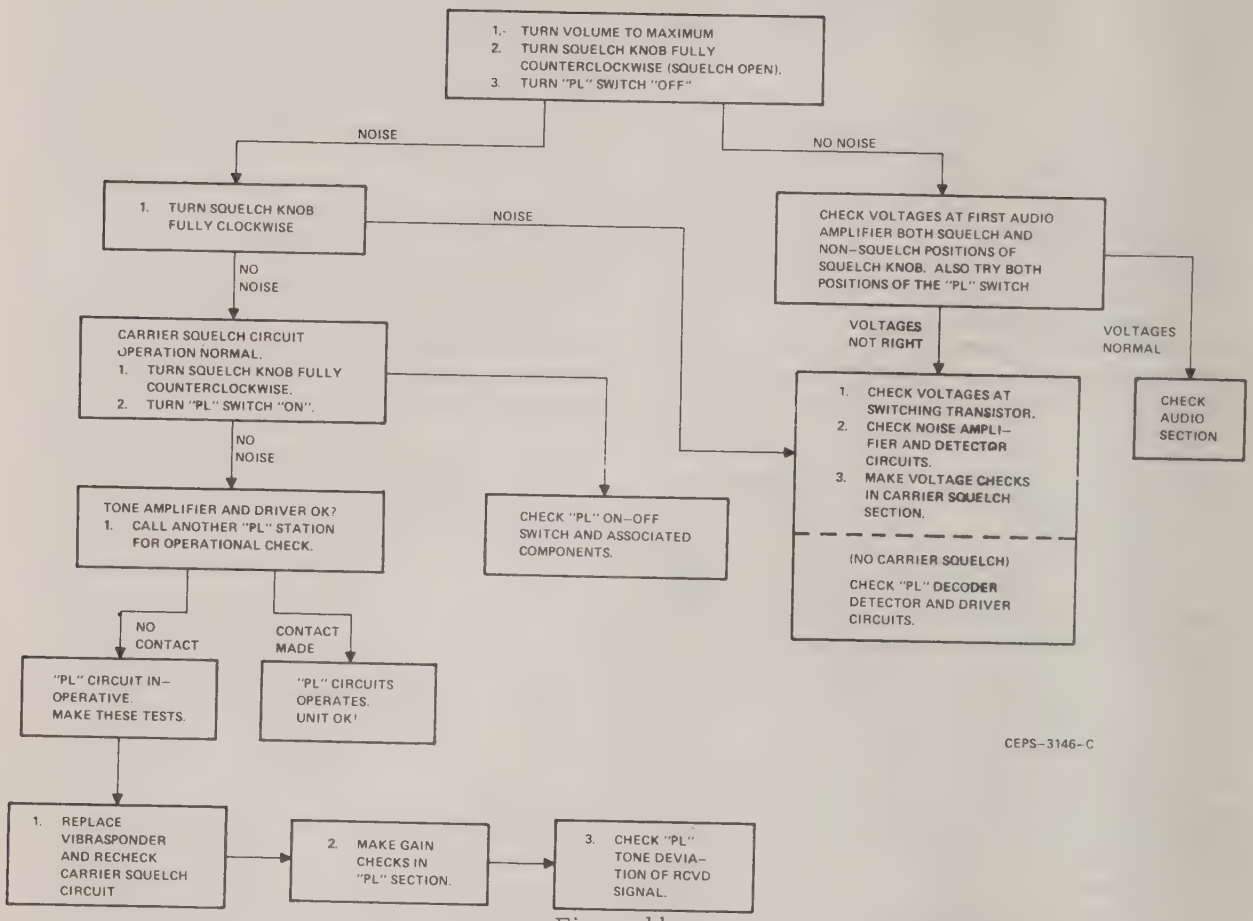

1. TURN VOLUME TO MAXIMUM
2. TURN SQUELCH KNOB FULLY COUNTERCLOCKWISE (SQUELCH OPEN).
3. TURN "PL" SWITCH "OFF"
NOISE
NO NOISE
1. TURN SQUELCH KNOB FULLY CLOCKWISE
NOISE
CHECK VOLTAGES AT FIRST AUDIO AMPLIFIER BOTH SQUELCH AND NON-SQUELCH POSITIONS OF SQUELCH KNOB. ALSO TRY BOTH POSITIONS OF THE "PL" SWITCH
NO NOISE
VOLTAGES NOT RIGHT
VOLTAGES NORMAL
CARRIER SQUELCH CIRCUIT OPERATION NORMAL.
1. TURN SQUELCH KNOB FULLY COUNTERCLOCKWISE.
2. TURN "PL" SWITCH "ON".
1. CHECK VOLTAGES AT SWITCHING TRANSISTOR.
2. CHECK NOISE AMPLIFIER AND DETECTOR CIRCUITS.
3. MAKE VOLTAGE CHECKS IN CARRIER SQUELCH SECTION.
CHECK AUDIO SECTION
NO NOISE
TONE AMPLIFIER AND DRIVER OK?
1. CALL ANOTHER "PL" STATION FOR OPERATIONAL CHECK.
CHECK "PL" ON-OFF SWITCH AND ASSOCIATED COMPONENTS.
(NO CARRIER SQUELCH)
CHECK "PL" DECODER DETECTOR AND DRIVER CIRCUITS.
NO CONTACT
CONTACT MADE
"PL" CIRCUIT INOPERATIVE. MAKE THESE TESTS.
"PL" CIRCUITS OPERATES. UNIT OK!
CEPS-3146-C
1. REPLACE VIBRASPONDER AND RECHECK CARRIER SQUELCH CIRCUIT
2. MAKE GAIN CHECKS IN "PL" SECTION.
3. CHECK "PL" TONE DEVIATION OF RCVD SIGNAL.

Figure 11.
Receiver "Private-Line" Tone-Coded Squelch Troubleshooting Chart

switch to OFF. Modulate the signal generator with 1000 Hz tone for 3.0 kHz deviation. Set the signal generator output to zero and increase until the tone is heard in the speaker. No more than 0.25 uV should be required to cause the tone.

(2) Full squelch sensitivity: 0.60 uV or less (0.30 uV with preamplifier). Set the SQUELCH control fully clockwise and apply an input signal as in step (1), preceding. No more than 0.60 uV should be required to produce the tone.

k. "Private-Line" Decoder

A general check of the "Private-Line" circuit performance may be conducted as follows:

(1) Receiver PL squelch sensitivity should be 0.25 uV (0.15 uV with preamplifier) or less. Place the radio in the PL mode. Turn the SQUELCH control fully counterclockwise. Modulate the signal generator with the "Private-Line" tone frequency stamped on the "Vibrasponder" Resonant Reed of the radio set. (This should be done with the Motorola SLN6221A "PL" Tone Generator to insure that the signal is modulated with the exact PL frequency.) Adjust the modulating tone for 0.5 kHz deviation. Set the signal generator output to zero and increase until noise is heard in speaker. No more than 0.25 uV should be required.

If "Private-Line" squelch sensitivity in the receiver is low or the circuit is inoperative, use TABLE II and the troubleshooting chart (Figure 11) to localize the trouble area.

(2) There should be no "squelch tail" (noise burst) at the end of a transmission from other stations in the communications system. A "squelch tail" is indicative of improper operaion of the

transmitter PL delay circuitry. Refer to the section on transmitter servicing.

4. "DIGITAL PRIVATE-LINE" CIRCUIT SERVICING

a. General

All theory of operation, test voltages, waveforms, and other servicing information for the "Digital Private-Line" encoder-decoder is included on the schematic diagram. The "Digital Private-Line" encoder-decoder uses a CMOS integrated circuit. CMOS devices should be handled with care. The precautions described in this section should be read carefully before servicing the "Digital Private-Line" encoder-decoder.

b. Handling Precautions for CMOS Integrated Circuits

Many of the integrated circuit devices used in communications equipment are of the CMOS (Complementary Metal Oxide Semiconductor) type. Because of their high open circuit impedance, CMOS ICs are vulnerable to damage from static charges. Care must be taken in handling, shipping, and servicing them and the assemblies in which they are used.

Even though protection devices are provided in CMOS IC inputs, the protection is effective only against overvoltage in the hundreds of volts range such as are encountered in an operating system. In a system, circuit elements distribute static charges and load the CMOS circuits, decreasing the chance of damage. However, CMOS circuits can be damaged by improper handling of the modules even in a system.

TO AVOID DAMAGE TO CIRCUITS, OBSERVE THE FOLLOWING HANDLING, SHIPPING, AND SERVICING PRECAUTIONS:

(1) Prior to and while servicing a circuit module, particularly after moving within the service area, momentarily touch both hands to a bare metal earth grounded surface. This will discharge any static charge which may have accumulated on the person doing the servicing.

(2) Whenever possible avoid touching any electrically conductive parts of the circuit module with your hands.

(3) When servicing a circuit module, avoid carpeted areas, dry environments, and certain types of clothing (silk, nylon, etc.) because they contribute to static buildup.

(4) All electrically powered test equipment should be grounded. Apply the ground lead from the test equipment to the circuit module before connecting the test probe. Similarly, disconnect the test probe prior to removing the ground lead.

(5) If a circuit module is removed from a system, it is desirable to lay it on a conductive surface (such as a sheet of aluminum foil) which is connected to ground through a resistance of approximately 100k.

WARNING

If the aluminum foil is connected directly to ground, be cautious of possible electrical shock from contacting the foil at the same time as other electrical circuits.

(6) When soldering, be sure the soldering iron is grounded.

(7) Prior to connecting jumpers, replacing circuit components, or touching CMOS pins (if this becomes necessary in the replacement of an integrated circuit device), be sure to discharge any static buildup as described in procedure 1. Since voltage differences can exist across the human body, it is recommended that only one hand be used if it is necessary to touch pins on the CMOS device and associated board wiring.

(8) When replacing a CMOS integrated circuit device, leave the device in its metal rail container or conductive foam until it is to be inserted into the printed circuit module.

(9) All low impedance test equipment (such as pulse generators, etc.) should be connected to CMOS device inputs after power is applied to the CMOS circuitry. Similarly, such low impedance equipment should be disconnected before power is turned off.

(10) Replacement modules shipped separately from the factory will be packaged in a conductive material. Any modules being transported from one area to another should be wrapped in a similar material (aluminum foil may be used). NEVER USE NONCONDUCTIVE MATERIAL for packaging these modules.

c. Performance Tests

If the decoder is operating properly, a 0.25 microvolt rf carrier modulated ±0.5 kHz with the appropriate digital PL code should unsquelch the receiver. This can be checked as follows:

(1) Connect the rf signal generator output to the radio set antenna jack and set the generator output level to minimum.

(2) Modulate the signal generator ±0.5 kHz with the appropriate "DPL" ("Digital Private-Line") code. The modulating signal can be obtained from a Motorola Model S6413A "Digital Private-Line" Test Set.

(3) Also modulate the signal generator with a 300 to 3000 Hz tone. Total deviation should be ±4 kHz, including "DPL" code.

(4) Increase the signal generator output level until the receiver unsquelches. No more than 0.25 uV should be needed to unsquelch the receiver.

The encoder should modulate the transmitter rf carrier at least ±0.5 kHz. The transmitted signal should unsquelch any properly-operating receiver that is equipped with the same "DPL" code and is operating in the "DPL" mode. After the microphone PTT button is released, the transmitter should remain keyed for about 180 milliseconds and the encoder should produce a turn-off code. No squelch tails should be heard in properly-operating "DPL" receivers. Validity of the "DPL" code and turn-off code can be checked with a Motorola S6413A "Digital Private-Line" Test Set.

d. Troubleshooting

If the encoder-decoder performance is unsatisfactory, first thoroughly inspect the radio set and, particularly, the "DPL" encoder-decoder board. Check for visible defects in circuit boards, components and wiring. After any visible defects have been corrected, test the radio set and "DPL" board operation again. If performance is still unsatisfactory, use the following troubleshooting chart to help you isolate the defective circuit and component.

"DIGITAL PRIVATE-LINE" ENCODER-DECODER TROUBLESHOOTING CHART

Use this troubleshooting chart as a supplement to the maintenance information on the schematic diagram.

SYMPTOM	PROBABLE CAUSE	CIRCUIT CHECKS
Transmitter has no power output. Transmit relay doesn't operate.	No A+ from PTT delay circuit.	1. Check PTT switch circuit. 2. Check PTT delay circuit.
Transmitter causes squelch tails in "DPL"-equipped receivers.	Turn-off code not being sent, or is of insufficient duration or deviation.	1. Check turn-off code deviation: should be ±500 to ±1000 Hz. Turn-off code should begin as soon as PTT button is released. Transmitter should remain keyed for 160 to 250 msec after PTT button is released. 2. Check PTT delay circuit. 3. Check U801-9: should be 0 V during delayed PTT. 4. Check Q821: must be off for proper low-pass filter operation during transmit.
Transmitter cannot unsquelch "DPL"-equipped receivers.	Insufficient transmitter "DPL" deviation.	Check "DPL" deviation: should be ±500 to ±1000 Hz.
	Incorrect or faulty "DPL" code.	1. Check U801-15 through U801-23 for proper octal code. 2. Check U801-9: should be +6 V (high).
	Encoder filter is malfunctioning.	Check encoder filter (Q801-803 and Q821) for proper operation.
	50 kHz oscillator is malfunctioning.	Check U801-4 for 50 kHz square wave. Rise time should be 750 nsec or less.
Receiver will not unsquelch in "DPL" operation.	Switch interface circuits are malfunctioning.	Check switch interface circuits (Q805 and Q806). Q806 emitter should be 12.8 V when U801-7 is high.
	U801 is not decoding properly.	1. Check U801-7: should be 6 V when decoding a valid code. 2. Check U801-1: should be 0 V. 3. Check U801-12 with oscilloscope. You should see 6 V p-p pulses 1.84 msec apart.

"DIGITAL PRIVATE-LINE" ENCODER-DECODER TROUBLESHOOTING CHART (Cont'd.)

SYMPTOM	PROBABLE CAUSE	CIRCUIT CHECKS
	50 kHz oscillator malfunctioning.	Check U801-4 for 50 kHz square wave. Rise time should be 750 nsec or less.
	U801 is not properly programmed.	Check U801-15 through U801-23 for proper octal code.
	U801 is in encode mode.	Check U801-9: should be low.
	Decoder filter and data conditioner malfunctioning.	Compare waveforms and voltages with those on the schematic diagram.
Excessive decoder falsing.	Decoder low-pass filter malfunctioning.	Check decoder filter response. At Q812 emitter the filter response should be -1 to -4 dB at 134 Hz and -12 to -15 dB at 250 Hz. Keep input signal below 400 mV p-p to keep CR803 and CR804 out of clip.
	Encoder-decoder U801 malfunctioning.	Check U801-7: should be low when no code is decoded.
	U803C in current source is on.	Check U803-9: should be 10.0 V when U801-7 is low.
Excessive blocking.	Decoder filter malfunctioning.	Check decoder filter response. See checks for excessive decoder falsing.
	Current source malfunctioning.	Check U803-9: should be 0.1 V when U801-7 is high.
Squelch open at all times in "DPL".	Switch interface circuit malfunctioning.	Check switch interface circuits (Q805 & Q806).
	U801 malfunctioning.	Check U801-7: should be 6 V except when valid code is decoded.
	Power supply voltage is not 6.2 V ±.5 V.	Check voltage at U801-24.
	50 kHz oscillator operating intermittently or at wrong frequency.	Check 50 kHz clock signal at U801-4: should be 50 kHz square wave. Rise time should be 750 nsec or less.

5. MULTIPLE FREQUENCY MODIFICATION CONNECTIONS

The MULTIPLE FREQUENCY RADIOS JUMPER AND COMPONENT CONNECTIONS TABLE lists the standard and optional transmit (C) and receive (R) combinations. Radio sets ordered with non-standard combinations are modified as necessary at the factory. New system requirements for different transmit-receive combinations are easily handled by field modification.

The table lists the frequency combination in the first column. The other columns on the same line indicate which resistors are removed to disable unused oscillators. Jumper columns indicate diodes to be jumpered to ground (for single-frequency operation) or diodes to be jumpered together. Jumpered diodes provide a ground path for the unused oscillator's control leads to activate a desired oscillator. Refer to the transmitter and receiver circuit board detail for component locations.

6. FRONT PANEL AND KEY LOCK REMOVAL

The radio set is completely accessible for service without removing the front panel. Unusual circumstances, such as front panel damage, may necessitate front panel replacement.

To remove the front panel, the key lock must be dismantled, the escutcheon removed and the four front panel screws must be removed. The escutcheon may be glued to the front panel so use care during its removal to prevent buckling. A special tool, Motorola Part No. 66A84909B01, is required to free the lock barrel from the outside housing which in turn permits the locking bar to be removed. Refer to the heatsink and housing detail in the rear of this instruction manual before attempting to remove the lock barrel.

The lock barrel is removed as follows:

(1) Insert the key into the lock and turn the key horizontally to the unlocked position.

(2) Insert tool (No. 66A84909B01), with the beveled edge of the tool facing upward, into the small slot in the front end of the lock.

(3) Push the tool in until it stops and turn 180° clockwise.

(4) Pull the key, this removes the key and the barrel from the lock housing.

(5) If the lock has a metal locking bar, remove the locking bar spring. Plastic lock bars do not require springs.

(6) Remove the lock bar.

Re-assembling the front panel and key lock is accomplished by reversing the order of the steps.

MULTIPLE FREQUENCY RADIO SETS
JUMPER AND COMPONENT CONNECTIONS TABLE

DESIRED FREQUENCY COMBINATION	2-FREQ. CONTROL HEAD (NOTE 2)	4-FREQ. CONTROL HEAD (NOTE 2)	NO MODIFICATION REQUIRED	TRANSMITTER OSCILLATOR MODIFICATIONS							RECEIVER OSCILLATOR MODIFICATIONS							TRANSMIT & RECEIVE OSCILLATORS ACTIVATED WHEN CONTROL HEAD FREQUENCY SWITCH IS IN THE POSITION INDICATED			
				REMOVE THE INDICATED RESISTORS			JUMPER THE INDICATED DIODE ANODES TOGETHER				REMOVE THE INDICATED RESISTORS			JUMPER THE INDICATED DIODE ANODES TOGETHER							
				R467	R473	R480	CR101	CR441	CR463	CR465	R427	R435	R443	440	CR430	CR431	CR432	POSITION 1	POSITION 2	POSITION 3	POSITION 4
C1-R1	X				X	X						X	X					T1/R1	T2/R2		
C1-R1		X	X															T1/R1	T2/R2	T3/R3	T4/R4
C1-R2	X			X	X	X	Note 1					X	X					T1/R1	T1/R2		
C1-R2		X		X	X	X	Note 1											T1/R1	T1/R2	T1/R3	T1/R4
C1-R3		X		X	X	X	Note 1											T1/R1	T1/R2	T1/R3	T1/R4
C1-R4		X		X	X	X	Note 1											T1/R1	T1/R2	T1/R3	T1/R4
C2-R1	X				X	X					X	X	X	Note 1				T1/R1	T2/R1		
C2-R1		X									X	X	X	Note 1				T1/R1	T2/R1	T3/R1	T4/R1
C2-R2	X				X	X						X	X					T1/R1	T2/R2		
C2-R2		X	X															T1/R1	T2/R2	T3/R3	T4/R4
C2-R3		X			X	X		●	●	●								T1/R1	T2/R2	T3/R3	T4/R4
C2-R4		X			X	X		●	●	●								T1/R1	T2/R2	T3/R3	T4/R4
C3-R1		X									X	X	X	Note 1				T1/R1	T2/R1	T3/R1	T4/R1
C3-R2		X										X	X		●	●	●	T1/R1	T2/R2	T3/R2	T4/R2
C3-R3		X	X															T1/R1	T2/R2	T3/R3	T4/R4
C3-R4		X				X			●	●								T1/R1	T2/R2	T3/R3	T4/R4
C4-R1		X									X	X	X	Note 1				T1/R1	T2/R1	T3/R1	T4/R1
C4-R2		X										X	X		●	●	●	T1/R1	T2/R2	T3/R2	T4/R2
C4-R3		X											X			●	●	T1/R1	T2/R2	T3/R3	T4/R3
C4-R4		X	X															T1/R1	T2/R2	T3/R3	T4/R4

NOTES:
1. INSTALL A JUMPER FROM THE ANODES OF THE INDICATED DIODE TO GROUND.
2. MODIFICATION REQUIRED DIFFER DEPENDING ON WHETHER A TWO-FREQUENCY OR FOUR-FREQUENCY CONTROL HEAD IS BEING USED.
3. TO MODIFY A MULTI-FREQUENCY RADIO FOR C1-R1 OPERATION WITH A SINGLE FREQUENCY CONTROL HEAD, PLACE JUMPER WIRES FROM THE ANODES OF CR101 AND CR40 TO GROUND. PLACE THE CRYSTALS IN OSCILLATORS T1 AND R1.

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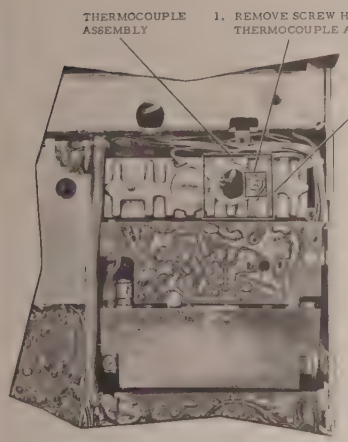
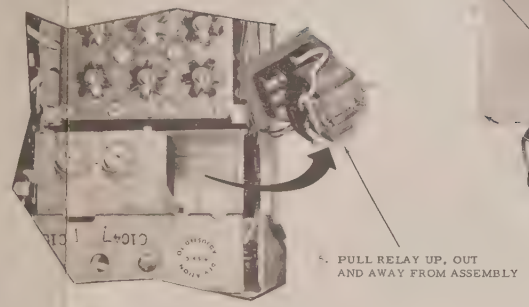
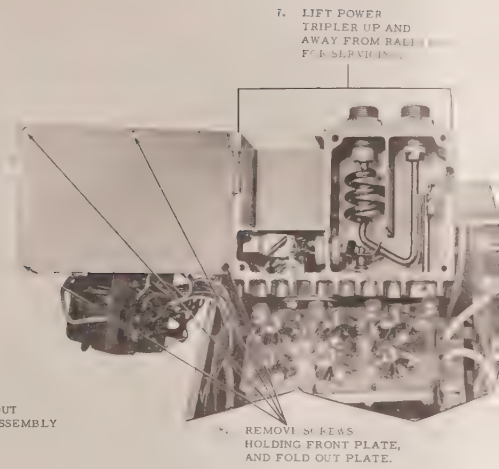

THERMOCOUPLE ASSEMBLY
1. REMOVE SCREW HOLDING THERMOCOUPLE ASSEMBLY
2. MOVE THERMOCOUPLE ASSEMBLY AWAY FROM VARACTOR ASSEMBLY





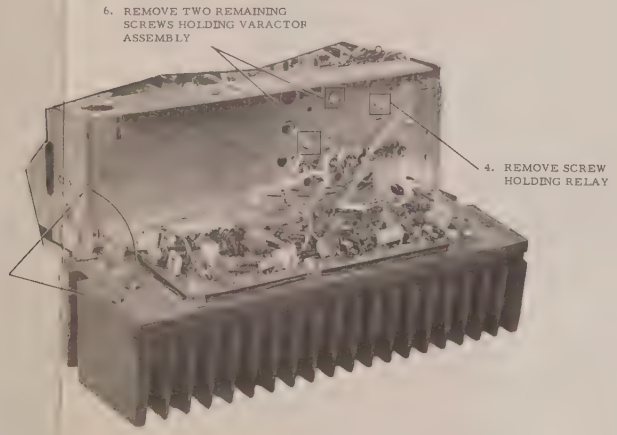

6. REMOVE TWO REMAINING SCREWS HOLDING VARACTOR ASSEMBLY
4. REMOVE SCREW HOLDING RELAY
3. FOLD OUT POWER AMPLIFIER ASSEMBLY

Figure 12.
Power Tripler Removal

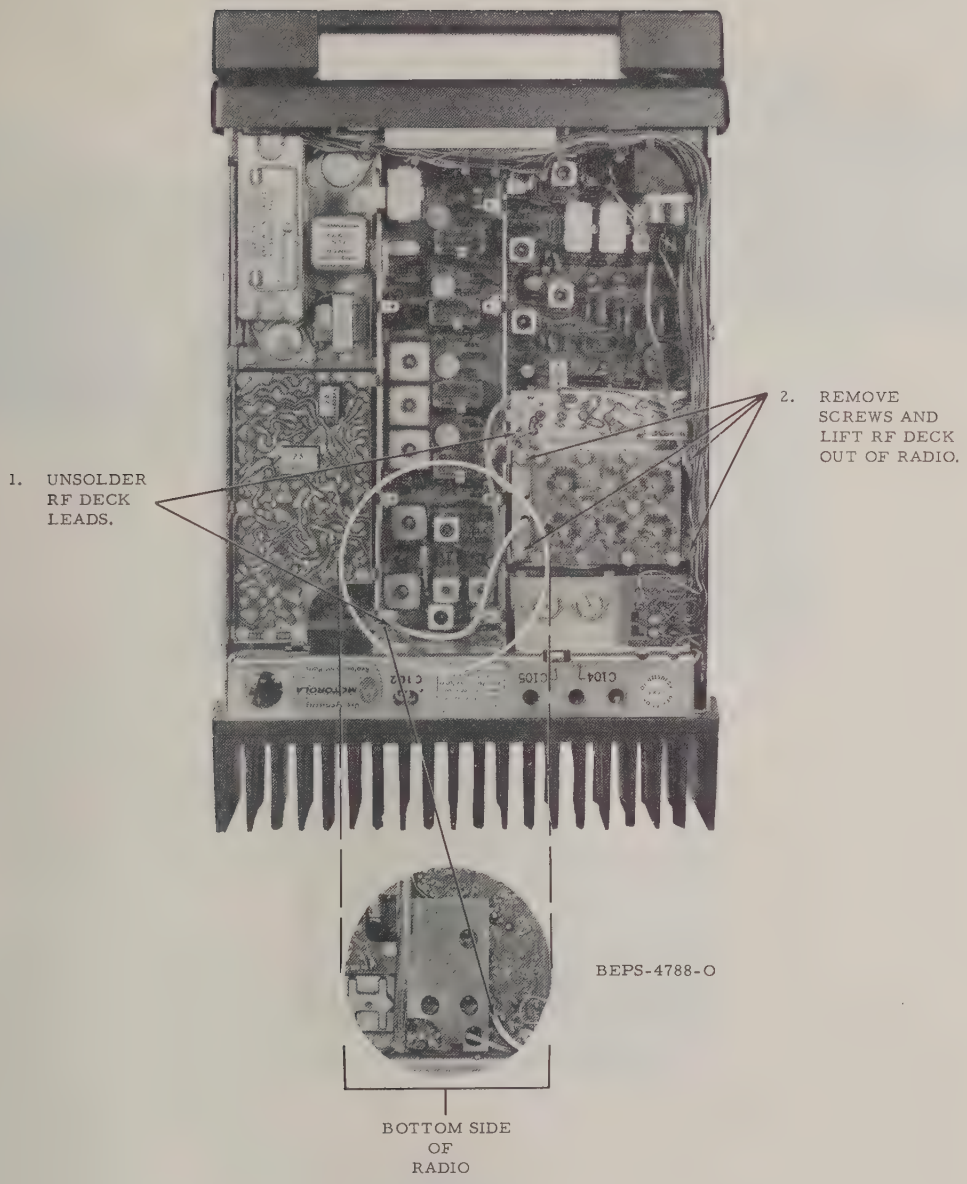


Figure 13
RF Deck Removal

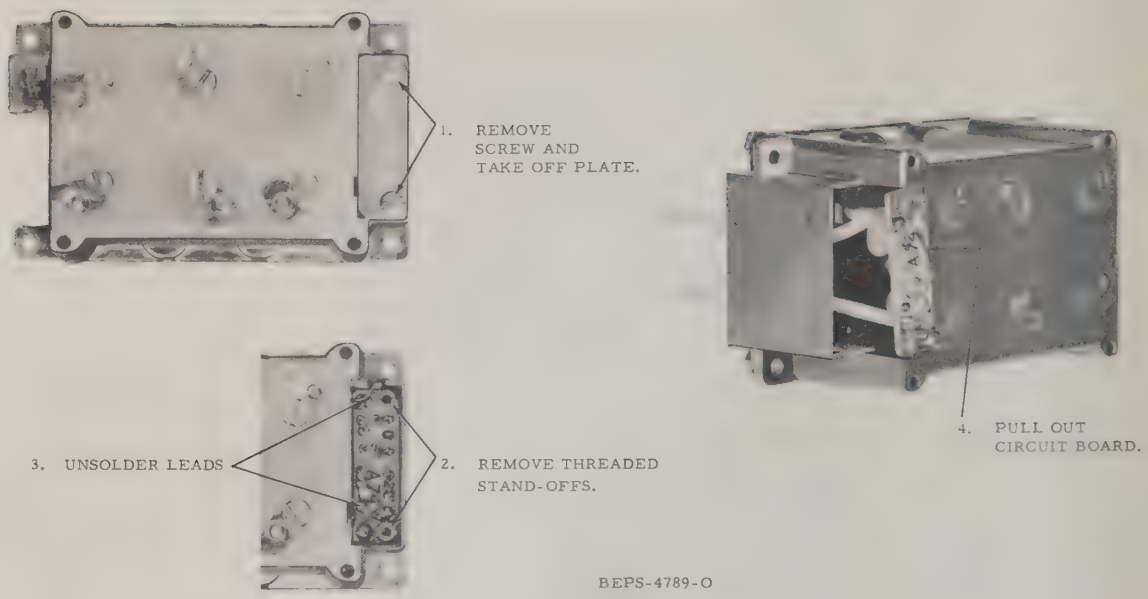


Figure 14.
RF Deck Disassembly

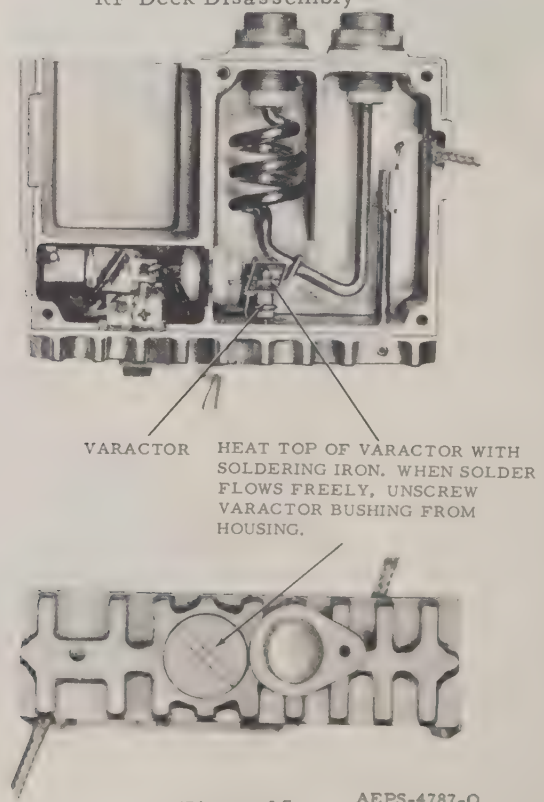

VARACTOR
HEAT TOP OF VARACTOR WITH SOLDERING IRON. WHEN SOLDER FLOWS FREELY, UNSCREW VARACTOR BUSHING FROM HOUSING.
AEPS-4787-O

Figure 15.
Varactor Diode Removal

TABLE OF RECOMMENDED TEST EQUIPMENT

TYPE OF EQUIPMENT OR TYPE OF MEASUREMENT	EQUIPMENT CHARACTERISTICS	RECOMMENDED TYPE
All	Select battery operated test equipment, where available, for versatility. Battery operated equipment permits testing in the vehicle or on the bench.	See your Motorola sales representative before ordering test equipment. He will analyze your requirements and help you select the latest available equipment to suit your individual needs. He can also advise you of new servicing equipment which becomes available after the printing of this manual.
Power supply for bench testing.	Capability: 13.6 V @ 15 amp	Motorola Model S1346A Regulated Power Supply, or Motorola T1012A Power Supply with Motorola TEK-15A Ripple Filter.
Test harness for bench testing	Must simulate conditions of installation in vehicle including fusing, volume and squelch controls, frequency selection, speaker loading.	"Mocom · 70" cables, control head, microphone and speaker, or Motorola TEK-25 or TEK-29 Universal Control Panel with TEKA-48 Accessory Power & Control Cable.
Portable test set	No equivalent. Use only recommended type.	Motorola S1056B to S1059B Series Portable Test Set with Motorola Model SKN6012B Metering Cable
Transmitter frequency measurement	Frequency - 50-500 MHz Accuracy - ±.00005% or better	Any of the following items of Motorola test equipment: Model S1343/1344 Series Digital Frequency/Deviation Meter Model S-1327 Series Service Monitor
Transmitter deviation measurement	Peak reading type for voice or sinusoidal wave; scales for accurate reading of ±5 kHz deviation (and ±1 kHz deviation for "Private-Line" models).	Motorola Model S1059B Portable Test Set, or Motorola S1344 Series Digital Frequency/Deviation Meter
Transmitter power output measurement	450-512 MHz; 50 ohms; at least 0-50 watt capability	Model S-1350A Wattmeter with T1013A Load Resistor and appropriate element
RF signal generator for receiver testing	450-512 MHz; FM; high stability - (±0.001% or better); adjustable output 0 to 100 millivolts	Motorola S-1318A Series Solid-State FM Signal Generator.
Audio voltage measurements	High impedance (10 megohm); dBm scale	Motorola Solid-State AC Voltmeter
Audio signal generator for audio circuit testing in receiver and transmitter	Variable amplitude 0 to 1 volt; 1000 Hz tone (300 to 3000 Hz preferred); sinusoidal wave.	Motorola Model S1067A Solid-State Audio Oscillator or Model TEK-1B Tone Oscillator
DC voltage measurements, resistance measurements, rf voltage measurements.	High impedance (11 megohm) dc multimeter.	Motorola Solid-State DC Multimeter with rf probe.
Waveform measurements	Oscilloscope: Audio circuit measurements	Any good quality oscilloscope
"Private-Line" tone injection for PL decoder circuit measurements	"Private-Line" tone generator using "Vibrasender" resonant reed for frequency accuracy; or audio oscillator with frequency counter for accurate setting of oscillator.	Motorola Model SLN6221A "Private-Line" Tone Generator

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TRANSMITTER PRE-ALIGNMENT NOTES

A. EXCERPTS FROM FCC REGULATIONS

FCC Regulations state that

1. Radio transmitters may be tuned or adjusted only by persons holding a 1st or 2nd class commercial radiotelephone operator's license or by personnel working under their immediate supervision.
2. The rf power output of a radio transmitter shall be no more than that required for satisfactory technical operation considering the area to be covered and the local conditions.
3. Frequency and deviation of a transmitter must be checked before it is placed in service and re-checked once each year thereafter.

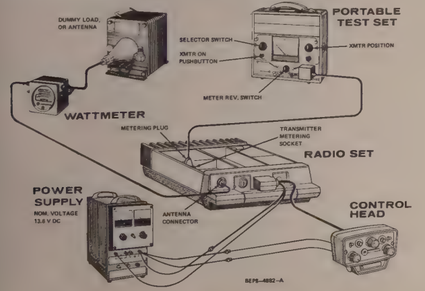
NOTE

Transmitters operating in the 450-470 MHz band are licensed to operate at or below a specified input power to the final amplifier. Use of this alignment procedure assures that this level will not be exceeded.

Transmitters operating in the 470-512 MHz band are licensed to operate at or below a specified effective radiated power (ERP). The ERP of a radio is dependent upon rf power output of the radio, antenna transmission line loss, antenna gain and antenna height. The rf power output for various ERP values of this radio are given in the ERP TABLE on the reverse side of this alignment procedure. Do not exceed the rf power output value specified.

B. TEST EQUIPMENT REQUIRED

1. Motorola S1056B to S1059B Series Portable Test Set with a Motorola Model SKN6012B Metering Cable. A 0-50 microampere meter with 20,000 ohms equivalent series resistance may be used if a test set is not available. A modified Motorola S1327A or S1327B Monitor or equivalent must be used for "Digital Private-Line" deviation measurements.
2. Motorola TLN4474A Alignment Tool Kit supplied with radio.
3. Motorola Model S-1350A Wattmeter or equivalent.
4. Motorola Model S1346A DC Power Supply or equivalent.
5. Motorola Model S1067A Audio Oscillator or equivalent.
6. Motorola Model S1344 Series Digital Frequency Meter/Deviation Calibrator.
7. Motorola Model S1053C Solid-State AC Voltmeter or equivalent.



Test Equipment Set-Up

C. HOW TO SET UP THE S1056A-9A PORTABLE TEST SET

1. Set function selector switch to XMTR position.
2. Place the oscillator and meter reversing switch in the OFF position.
3. Connect the 20-pin meter cable plug to the test set; connect the other end of the cable to the transmitter metering socket. When the test set is not being used, disconnect the 20-pin metering cable to conserve internal battery life. The plug on the cable acts as an on-off switch completing the battery circuit.

D. HOW TO KEY THE TRANSMITTER

1. Connect the rf wattmeter to the front panel antenna receptacle.
2. Key the transmitter with XMTR-ON switch on the test set or with a microphone plugged into the test set or radio set control head.

CAUTION

Do not key the transmitter for more than a few seconds at a time until it is properly tuned. Turn on the transmitter for brief periods while reading the meter and making the adjustments.

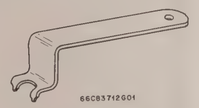
E. FREQUENCY CALCULATIONS

FREQUENCY (MHz)	CALCULATION
450-512	$f_o = \frac{f_c}{27}$

Where f_o = crystal frequency, f_c = carrier frequency

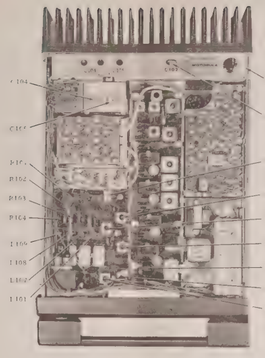
F. TEST SET SELECTOR SWITCH POSITIONS

S1056A-9A SERIES TEST SET	3	5	7
CIRCUIT METERED	Base of Buffer Amplifier	Output of 1st Amplifier	Final Amplifier Current



SPANNER WRENCH

Alignment Tool



AEPS-4871-O

Transmitter Adjustment Locations

G. TRANSMITTER ADJUSTMENT

Steps 1 thru 8 apply to all radios.

STEP	TEST SET SWITCH POSITION	ADJUSTMENT	METER READING	PROCEDURE
1		L101, L107, L108, L109, L102, L103, L104, L105, L106, C101, C102, C103, C104, C105, R105		This step is required only if the controls have been drastically misaligned, or if the transmitter frequency is being changed. If necessary, pre-position transmitter coil slugs L101, L107, L108, L109, L102, L104 and L105 to top of coil forms (i.e., the end of form farthest from circuit board). Pre-position coil slugs L103 10-1/2 turns from top of coil form and L106 15-turns from top of coil form. Set 1st amplifier trimmer capacitor (C101) 1/2-turn from fully clockwise position. Set power amplifier interstage capacitor (C102) fully clockwise. Set power amplifier output capacitor (C103) 1-turn from the fully clockwise position. Turn power tripler tuning screws (C104, C105) clockwise until they "bottom out". DO NOT FORCE. For 450-470 MHz radios only, turn C104 and C105 two complete turns counterclockwise from the full clockwise position. For all radios, turn power control (R105) fully clockwise (minimum power output position).

G. TRANSMITTER ADJUSTMENT (CONT'D)

Steps 1 thru 8 apply to all radios.

STEP	TEST SET SWITCH POSITION	ADJUSTMENT	METER READING	PROCEDURE
2				Key transmitter.
3	3	L102, L103	PEAK	Tune the oscillator output coils L102 and L103, in that order, for a peak reading in position 3. For multi-frequency radios, make all tuning adjustments on the lowest transmitter frequency.
4		L104		Tune L104 for a PEAK indication on meter 5 if possible. If position 5 does not read, tune L104 for a minimum reading in meter position 3.
5	5	L105, L106	PEAK	Tune the tripler output coils L105 & L106, in that order, for a peak reading in position 5.
6	5	C101	PEAK	Tune the 1st amplifier output trimmer capacitor, C101, for a peak reading in position 5.
7	5	L102, L103, L104, L105, L106, C101	PEAK	Repeat step 3. Tune L104 for a peak indication on position 5. Repeat steps 5 and 6.
8	Wattmeter	R105		Set the power output control, R105 fully counter-clockwise for maximum power output.

Steps 9 thru 11 pertain only to 450-470 MHz radios.

9	Wattmeter	C105, C104, C103, C102	PEAK	Be sure R105 is set per step 8. Tune C105, C104, C103, and C102, in that order for max. power output.
10	5	C101	PEAK	Tune 1st amplifier output trimmer, C101, for a peak reading in position 5.
11	Wattmeter	C105, C104, C103, C102	PEAK	Repeat step 9.

Steps 12 thru 14 pertain only to 470-512 MHz radios.

12	Wattmeter	R105, C103, C105 C104, C102	PEAK	Be sure R105 is set per step 8. Tune C103, C105, C104, C103 again, and C102, in that order, for max. power output. IMPORTANT Two peaks may be observed when tuning C104. Tune to the peak nearest maximum clockwise rotation (maximum capacitance).
13	5	C101	PEAK	Tune 1st amplifier output trimmer, C101, for a peak reading in position 5.
14	Wattmeter	R105, C103, C105, C104, C102	PEAK	Tune C103, C105, C104, C103 again, and C102, in that order, for maximum power output. If two peaks are observed while tuning C104, tune to the peak nearest maximum clockwise rotation.

Steps 15 thru 20 pertain to wide-spaced transmitters only (i.e., multi-frequency transmitters with channel separation in excess of 1.0 MHz but not exceeding 5.5 MHz).

15		R105		Set the power output control R105 fully clockwise.
16	3	L102	Equal readings on f_{high} & f_{low}	Alternately switch between the highest and lowest transmit frequencies and adjust L102 for equal readings on meter 3.
17	5	L105	Equal readings on f_{high} & f_{low}	Alternately switch between the highest & lowest transmit frequencies and adjust L105 for equal readings on meter 5.

ALIGNMENT CONTINUED ON REVERSE SIDE

G. TRANSMITTER ADJUSTMENT (CONT'D)

STEP	TEST SET SWITCH POSITION	ADJUSTMENT	METER READING	PROCEDURE
18	3, 5	L102, L105	Equal readings on f_{high} & f_{low}	Repeat steps 16 and 17 until meter 3 and meter 5 readings deviate less than 2 uA when transmitter is switched from highest to lowest frequency.
19	Wattmeter	R105		Set power output control R105 fully counterclockwise for maximum power output.
20	Wattmeter	C105	Equal readings on f_{high} & f_{low}	If power output is not within 2 watts on highest and lowest frequencies, tune output screw of power tripler, C105, for nearly equal power levels.
Steps 21 and 22 apply to all radios.				
21	Wattmeter	C104, C105	Equal readings on f_{high} & f_{low}	Use Spanner Wrench provided in tuning tool kit to tighten locknuts on tuning screws C104 and C105. Use caution to avoid detuning these capacitors. Check power output on all frequencies.
22	7	C103	Not more than 40 uA	Meter position 7 should read less than 40 uA. If necessary, turn C103 counterclockwise until meter 7 reads 40 uA.
Steps 23 and 24 pertain only to 450-470 MHz radios.				
23	Wattmeter	R105	30 Watts	Set the power output control, R105, in the following manner. On multi-frequency radios use the transmit channel with the lowest power output. If the rf power output exceeds 30 watts, adjust R105 until power output is reduced to 30 watts. If power output is between 25 watts and 30 watts, increase the dc supply voltage until power output is equal to 31 watts and adjust R105 for 30 watts out.
24			25 Watts minimum	On multi-frequency transmitters, check power output on all channels. If power on any channel is less than 25 watts, use that channel and readjust R105 as per step 23.
Steps 25 and 26 pertain only to 470-512 MHz radios.				
25	Wattmeter	R105		Refer to the model number of the radio and find its listing in the ERP TABLE. Set the power output control R105 for the power output specified in the ERP TABLE.
26	Wattmeter	R105		On multi-frequency models check the power output on all channels. If the power output exceeds that specified in the table, readjust R105 for the specified value.

*ERP TABLE

Radio Model	*ERP	RF Power Output	Antenna		Antenna Gain	Cable Supplied/Loss Per Ft.
			470-494 MHz	494-512 MHz		
U24BCA Series T24BCA Series D24BCA Series	10 Watts	15 Watts	TAE6054A	TAE6054A	0 dB	30-475378 (RG-58A/U) 0.13 dB/FT
U24BCA Series T24BCA Series D24BCA Series	25 Watts	17 Watts	TAE6074A	TAE6075A	3.5 dB	30-475378 (RG-58A/U) 0.13 dB/FT
U34BCA Series T34BCA Series D34BCA Series	50 Watts	21 Watts	TAE6094A	TAE6095B	5.0 dB	30-82921H01 0.095 dB/FT

*ERP = Effective Radiated Power

NOTE

The FCC restricts transmitters in the 470-512 MHz range to operate at or below a specified ERP. Therefore, the rf power output of the radio should not exceed the values specified in the table.

H. FINAL METER READINGS

1. Each time a transmitter is aligned or tested, final meter readings should be made and entered in a logbook.
2. All readings given in the following table are minimum (based on a nominal dc supply voltage of 13.6 volts) except M7 (final amplifier current) which is a maximum reading.
3. The readings at positions 3 and 5 are purely relative and do not give actual current or voltage measurements.
4. Multiply the microampere scale reading obtained in position 7 by 0.2 to determine the actual final amplifier current in amperes.

EXAMPLE: Meter Reading = 40 uA
Multiplying Factor = 0.2
Actual Current = 40 x 0.2 = 8 amperes

TRANSMITTER METERING TABLE

S1056A-9A SERIES SWITCH POSITION	3	5	7
METER READING	5 uA min (normal tuning) 3 uA min (wide space tuning)	15 uA min (normal tuning) 8 uA min (wide space tuning)	40 uA (max)
CIRCUIT METERED	Oscillator Output	Exciter Output	Final Amplifier Current

I. OSCILLATOR FREQUENCY ADJUSTMENT

Setting the oscillator "on frequency" should be done after the transmitter has been aligned, but before transmitter deviation is checked and set. To set the oscillator on frequency, perform the following steps:

1. Set up the frequency meter as described in the frequency meter instruction manual.
2. Set the frequency selector switch on the control head to the F1 position (multi-freq. units only).
3. Key the transmitter with no modulation using the portable test set. On "Private-Line" tone-coded squelch models, disable the "Private-Line" tone generator by removing the "Vibrasender" resonant reed. On "Digital Private-Line" binary-coded squelch models disable the encoder output by shorting the code disable points located between +6.2 V and the junction of R807 and R808.
4. Adjust L101 for proper readings on the frequency meter. If the frequency as indicated on the frequency meter is too low, turn slug of L101 counterclockwise; if too high, turn clockwise.
5. Set the frequency selector switch to the F2 position and repeat step 4 using L107.
6. Repeat step 5 for F3 and F4 using L108 and L109 respectively.
7. On "Private-Line" models, reinsert the "Vibrasender" resonant reed into the tone generator board or disconnect code disabling jumper.

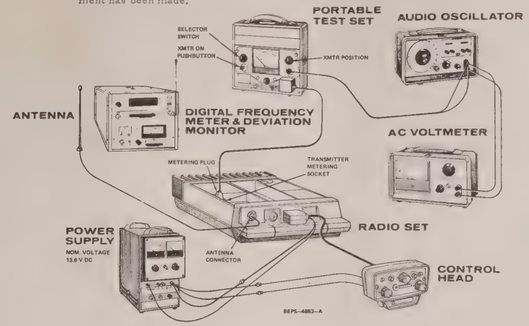
NOTE

Omit steps 5 and 6 for single-frequency units.

J. "IDC" ADJUSTMENT PROCEDURE

NOTE

The IDC Adjustment must be made after the oscillator frequency adjustment has been made.



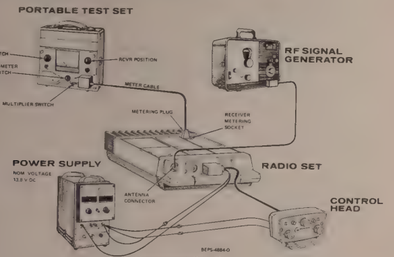
IDC Adjustment Test Equipment Set-Up

1. Insert the "Vibrasender" resonant reed or code plug in "Private-Line" squelch models.
2. Connect the output leads of the tone oscillator through a 0.33 uF capacitor to the transmitter audio input (microphone receptacle).
3. Connect the ac voltmeter across the same terminals and adjust the tone generator output to 1 volt at 1000 Hz.
4. Place the control head frequency selector switch in the F1 position (in multiple-frequency models) and key the transmitter using the portable test set. Adjust the F1 IDC control, R101, for 5 kHz deviation as read on the deviation measuring instrument used. For multiple frequency models adjust the F2, F3 and F4 IDC controls (R102, R103, and R104 respectively) with the frequency selector switch in the corresponding position.
5. Reduce the tone oscillator output to 200 millivolts. Essentially full deviation should still be indicated. Less than full deviation may indicate a weak audio stage or other lack of audio gain.
6. Remove the 1000 Hz modulation. "Private-Line" tone deviation should be between 0.5 to 1 kHz. "Digital Private-Line" deviation should be between 0.5 and 1 kHz; see B1 above.

RECEIVER ALIGNMENT PROCEDURE

A. TEST EQUIPMENT REQUIRED

1. Motorola S1056B to S1059B Series Portable Test Set with Motorola Model SKN6012B Metering Cable.
2. Motorola Model S1346A Regulated Power Supply (or equivalent).
3. Motorola S-1316A Series Solid-State FM Signal Generator or equivalent.
4. Motorola TLN4474A Alignment Tool Kit (supplied with radio). A small screwdriver may be used for some of the adjustments.



Test Equipment Set-Up

B. HOW TO SET UP THE S1056A-9A PORTABLE TEST SET

1. Set function selector switch to RCVR position.
2. Switch on 455 kHz crystal oscillator.
3. Connect the 20-pin meter cable plug to the test set; connect the adapter cable to the cable coming from the test set; connect the other end of the adapter cable to the receiver metering socket. When the test set is not in use, disconnect the 20-pin metering cable to conserve internal battery life. The plug on the cable acts as an on-off switch completing the battery circuit.
4. Connect the rf extension cable to the test set; connect the rf probe cable to the rf extension cable.

C. HOW TO SET UP THE SIGNAL GENERATOR FOR RF ALIGNMENT

1. Set up the signal generator according to the instructions supplied with the unit.
2. Connect the signal generator cable to the antenna input.
3. Turn the generator output up to maximum.
4. Keep the test set in position 4.
5. Rotate the signal generator dial back and forth near the assigned rf carrier frequency. Watch the test set meter. The pointer should swing above and below the zero reading as the dial is rotated if the discriminator has been properly aligned. Set the dial for exact zero meter reading. Be sure the generator frequency is kept at zero meter reading.

D. TEST SET SELECTOR SWITCH POSITIONS

S1056A-9A TEST SET POSITION	1	3	4	5	6	11
TYPICAL NO SIGNAL READING	0 uA	16 uA	0 uA	25 uA	1h uA	
CIRCUIT METERED	Base of 3rd 455 kHz IF Amplifier	Base of the Multiplier Tripler	Discriminator Zero	3rd 455 kHz Limiter Output	1st Oscillator Activity	Audio Output

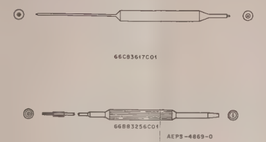
E. FREQUENCY CALCULATIONS

450-512 MHz

$f_c - 27 f_{osc} = 11.7$ MHz

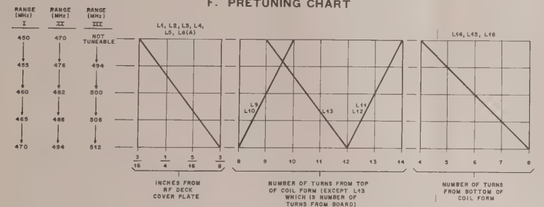
rf carrier input | multi. factor | 1st osc. crystal freq. | 1st mixer output (1st i-f)

$$f_{osc} = \frac{f_c - 11.7\ \text{MHz}}{27}$$



Alignment Tools

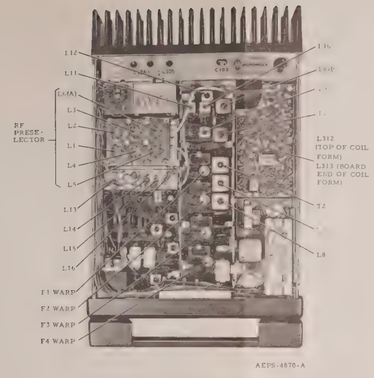
F. PRETUNING CHART



G. RECEIVER ALIGNMENT

455 kHz DISCRIMINATOR ALIGNMENT

STEP	TEST SET SWITCH POSITION	ADJUSTMENT	METER READING	PROCEDURE
1		L312 Disc. Primary		Position slug flush with top of coil form.
2		L313 Disc. Secondary		Position slug to bottom of form (next to circuit board).
3	5	Discriminator Primary (Top Slug) L312	PEAK	Inject a strong 455 kHz crystal-controlled signal from portable test set (25 uA minimum in position 1) to the input of the 455 kHz filter (collector of 2nd mixer - Q6). Tune L312 for a peak indication on meter position 5.
4	4	Disc. Secondary (Bottom Slug - nearest to circuit board) L313	ZERO	Tune exactly to zero. DO NOT readjust primary.



Receiver Adjustment Locations

G. RECEIVER ALIGNMENT (CONT'D)

455 kHz DISCRIMINATOR ALIGNMENT

STEP	TEST SET SWITCH POSITION	ADJUSTMENT	METER READING	PROCEDURE
5		L9, L10, L11 L12, L13, L14, L15, L16		This step is required only if these coils have been drastically misaligned, or if the receiver frequency is being changed. If necessary, preposition the oscillator multiplier coil slugs according to the pretuning chart.

FIRST OSCILLATOR MULTIPLIER ALIGNMENT

6	6	L9, L10	PEAK	Tune L9 and L10 for a peak indication on position 6.
7	3	L11, L12, L13	PEAK	Tune L11, L12 and L13 for a peak indication on position 3.
8	6, 3	L9, L10, L11, L12, L13	PEAKS	Repeat steps 6 and 7.
9		L1, L2, L3, L4, L5, L6 (A)		This step is required only if these coils have been drastically misaligned or if the receiver frequency is being changed. RF DECK - use a screwdriver to preset the rf deck tuning screws L1 thru L6 (A) by turning the tuning screws counterclockwise (away from the top plate) until screws protrude according to the pretuning chart.

G. RECEIVER ALIGNMENT (CONT'D)

FIRST OSCILLATOR MULTIPLIER ALIGNMENT

STEP	TEST SET SWITCH POSITION	ADJUSTMENT	METER READING	PROCEDURE
10	1	L14, L15, L16	PEAK	Set signal generator "on frequency" and tune L14, L15, and L16 for peak indication in position 1. Reduce signal generator level as necessary to maintain a meter 1 reading of below 30 uA. Repeat the procedures, carefully tuning all coils to a precise peak.

1ST IF AND RF DECK ALIGNMENT

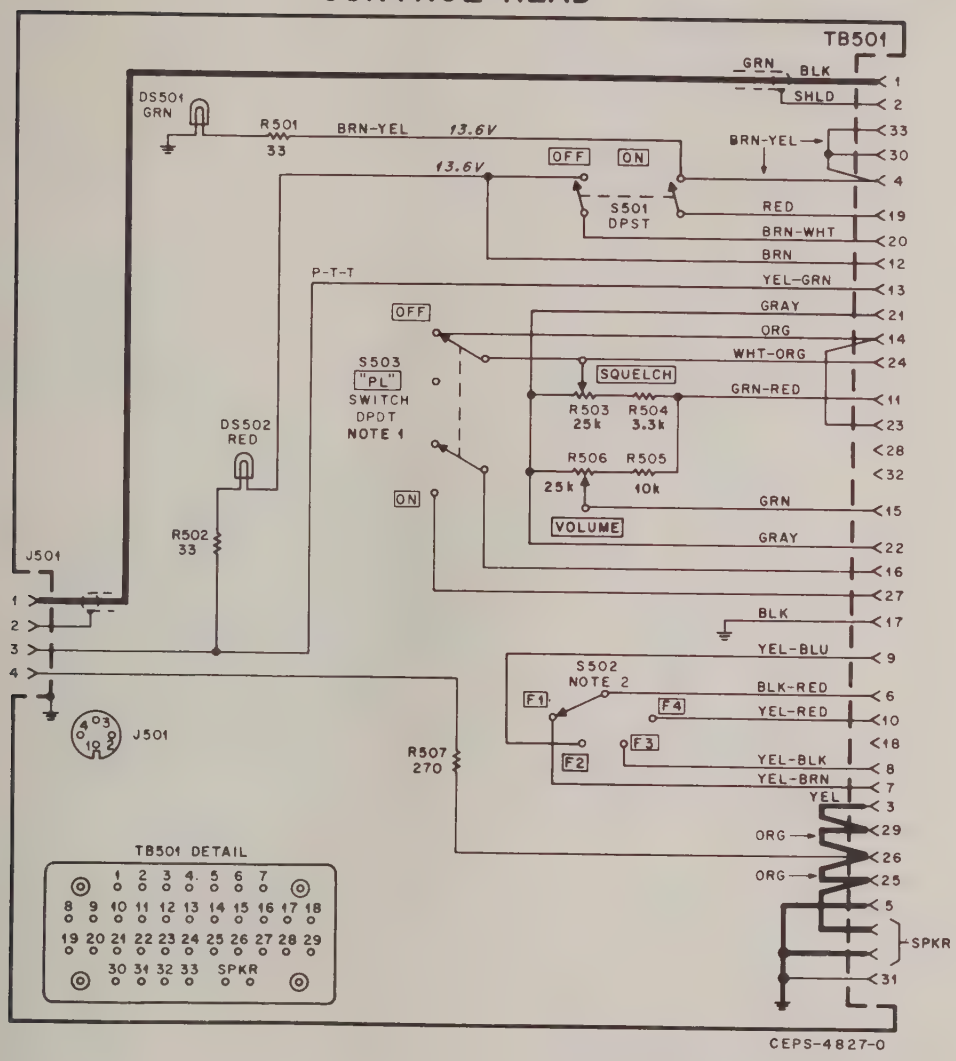
11	1	L1, L2, L3, L4, L5, L6 (A)	PEAK	RF DECK - If the radio is equipped with the optional preamplifier, disconnect and bypass the preamplifier. Tune L1 through L6 (A) in that order for a maximum indication on meter position 1. Reduce generator output level as required to keep meter 1 reading below 30 uA.
12	1	L6 (B), T1, T2, L7, L8	PEAK	11.7 MHz IF - with rf generator on carrier frequency, tune coils L6 (B), T1, T2, L7 and L8 for a peak indication on meter position 1. Reduce rf generator output as required to maintain meter 1 reading below 30 uA. (Coils should tune with slugs positioned approximately 4-1/2 turns from top of form. Preposition slugs to facilitate tuning if high i-f has been drastically misaligned.)
13	1	L14, L15, L16, L1, L2, L3, L4, L5, L6 (A)	PEAK	Repeat steps 10 and 11.
14	11 or Audio Voltmeter	L15, L16, L5, L6 (A)	Best Quieting	Reduce the rf generator input to the 20 dB quieting level. Retune L15 and L16 on the injection tripler and L5 and L6 (A) on the rf deck for best quieting.
15*	1	C1, C2	PEAK	RF PREAMPLIFIER - If the radio is equipped with an optional preamplifier, reconnect the preamplifier. Tune C1 and C2 for a peak indication on position 1. Reduce generator output level to keep meter 1 reading below 30 uA.
16*	11 or Audio Voltmeter	C1, C2, L1, L2	Best Quieting	Reduce the signal generator output to the 20 dB quieting level and repeat C1 and C2 on the preamplifier and L1 and L2 on the rf deck for best quieting sensitivity.

*Skip this step unless the radio set is equipped with an optional RF Preamplifier.

RECEIVER FREQUENCY ADJUSTMENT

17	4	C1 (Freq. #1) C2 (Freq. #2) C3 (Freq. #3) C4 (Freq. #4)	0 uA	With a carrier of known frequency on the air, set the corresponding oscillator warp capacitor to obtain a 0 uA reading in meter position 4. If the radio's receiver and transmitter are on the same frequency and if the transmitter is warped "on frequency", then the receiver may be netted to the transmitter by using the built-in netting function. Remove one end of the wire netting jumper, located near L105 in the exciter, from its pin and connect it to the pin located near CR180 in the exciter IDC circuit. This activates the low level exciter stages, which quiets the receiver. Set the corresponding receiver oscillator warp capacitor to obtain a 0 uA reading in meter position 4.

TRUNK-MOUNT CONTROL HEAD



NOTES:

1. S503 AND ASSOCIATED WIRING USED IN "PRIVATE-LINE" MODELS ONLY.
2. S502 AND ASSOCIATED WIRING USED IN MULTIPLE FREQUENCY MODELS ONLY.

EPS-4864-O

PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Control Head Used in 1- & 4-Frequency Radio Sets
Schematic Diagram
Motorola No. 63P81011E42-A
8/20/75-PO

PARTS LIST

CONTROL HEADS

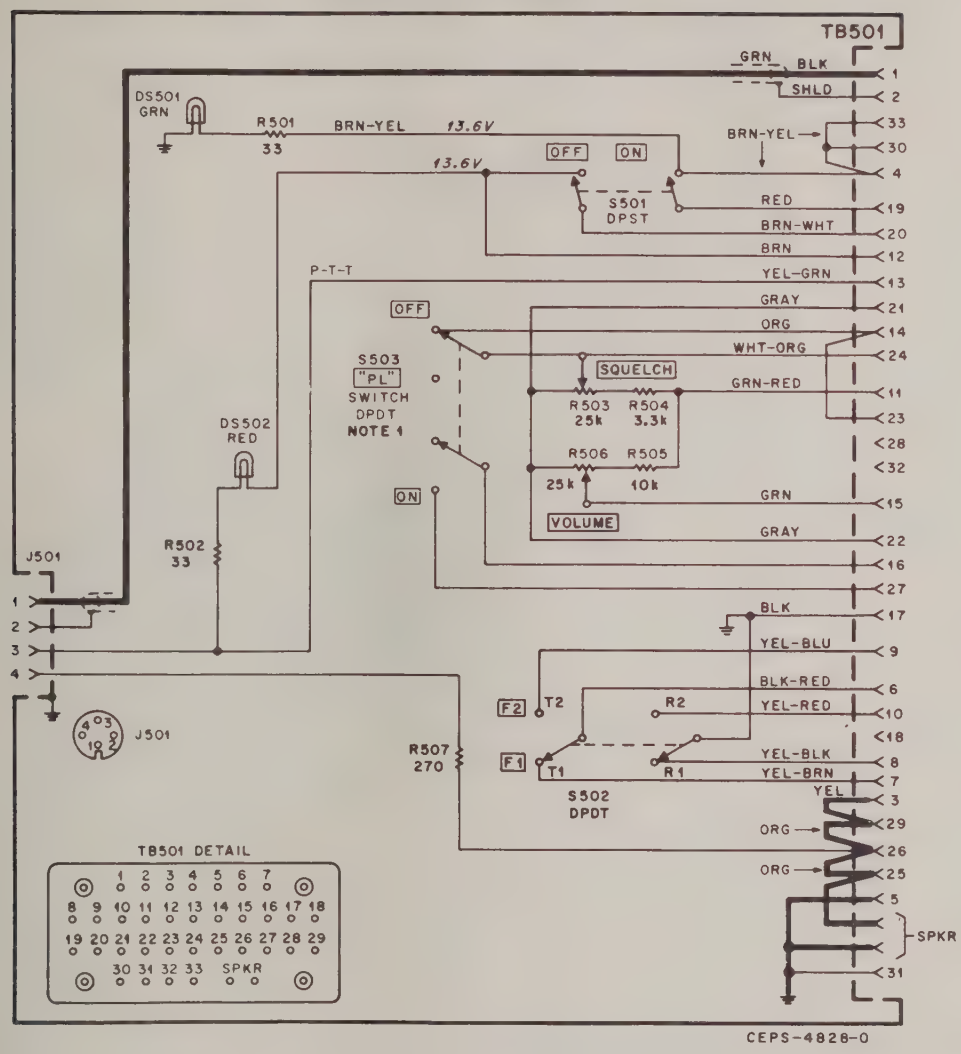
TRUNK-MOUNT
1-FREQ. & 4-FREQ.

TCN6026AE (Carrier Squelch, 1-Freq.)
TCN6026AG ("Private-Line" Tone-Coded Squelch, 1-Freq.)
TCN6026AJ (Carrier Squelch, 4-Freq.)
TCN6026AK ("Private-Line" Tone-Coded Squelch, 4-Freq.)

PL-772-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
DS501, 502	65K4151	LAMP, incandescent: min. bay.; 6-8 V; 0.2 A; type No. 51
J501	9K830418	CONNECTOR, receptacle: female; 4-contact; does not include: 4S7699 LOCKWASHER: 13/16" internal; 2A482070 NUT, machine: ring type (knurled)
		RESISTOR, fixed: ±10%; 1/2 W: unl stated
R501, 502	17C82350A04	33 ±10%; 2 W
R503	18K857840	variable: 25K ±30%; 0.33 W
R504	6S5581	3.3K
R505	6S6320	10K
R506	18K868896	variable: 25K ±30%; 0.33 W; includes switch S501 (TCN6026AE, AJ)
	or18C857698	variable: 25K ±30%; 0.33 W (TCN6026AG, AK)
R507	6S6336	270; 1 W
		SWITCH:
S501		dpst; p/o R506 (TCN6026AE, AJ)
	or40K80247	toggle: dpst (TCN6026AG, AK)
S502	40C83624D01	rotary: 1-pole; 4-position; non-shorting
S503	40A80246	toggle: dpdt
		TERMINAL BOARD:
TB501	31C83826D02	35 female contacts
		LAMPHOLDER:
XDS501, 502	9B863168	miniature bayonet type
	NON-REFERENCED ITEMS	
	61B83678D01	LENS, indicator light: RED
	61B83678D02	LENS, indicator light: GRN
	3A82670A01	SCREW, machine: special type; 2 req'd (control head mounting)
	36K858652	KNOB, control: 2 req'd (VOL & SQ.)
	36B82869D01	KNOB, control: (freq. selector)
	26B83806D01	SHIELD, light: (for light-dependent resistor located on "dimmer" board)
	3A82227A02	SCREW, machine: special type: 4 req'd
	15C82401D01	COVER, housing: (back)
	1V868494	HOUSING, control head
	13D857971	ESCUTCHEON (TCN6026AE)
	13D857975	ESCUTCHEON (TCN6026AG)
	13D82286C23	ESCUTCHEON (TCN6026AJ)
	13D82286C22	ESCUTCHEON (TCN6026AK)
	7B82400D01	BRACKET, control head mounting
	3S7302	SCREW, machine: 10-32 x 3/8" plain hex head; 2 req'd (for mounting control head on bracket
	3S7544	SCREW, tapping: No. 8 x 1/2" plain hex head; 3 req'd. (for mounting bracket)

TRUNK-MOUNT CONTROL HEAD



NOTES:

1. S503 AND ASSOCIATED WIRING USED IN "PRIVATE-LINE" MODELS ONLY.

EPS-4832-O

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

Control Head Used in 2-Frequency
Radio Sets Schematic Diagram
Motorola No. 63P81011E43-A
8/20/75-PO

PARTS LIST

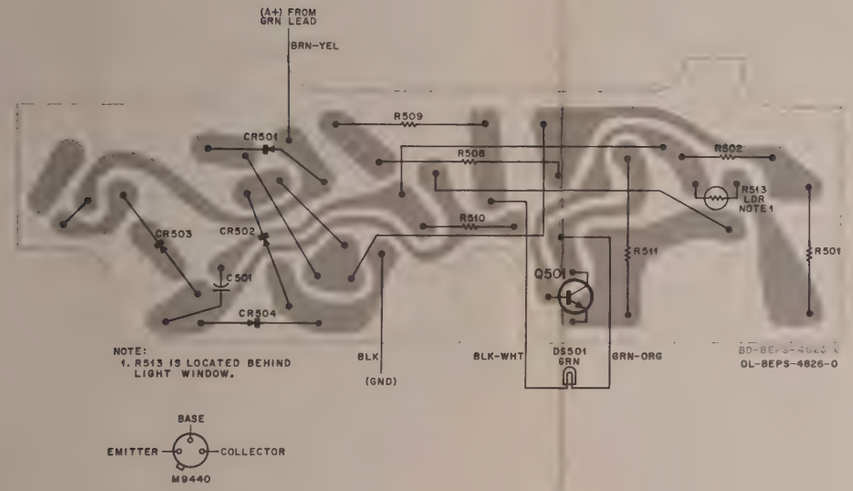
CONTROL HEADS

TRUNK-MOUNT, 2-FREQUENCY

TCN6026AF (Carrier Squelch)
TCN6026AH ("Private-Line" Tone-Coded Squelch)

PL-775-D

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		LAMP, incandescent:
DS501, 502	65K4151	min. bay.; 6-8 V; 0.2 A; type No. 51
		CONNECTOR, receptacle:
J501	9K830418	female; 4-contact; does not include: 4S7699 LOCKWASHER; 13/16" internal; 2A482070 NUT, machine: ring type (knurled)
		RESISTOR, fixed: ±10%; 1/2 W: unl stated
R501, 502	17C82350A04	33 ±10%; 2 W
R503	18K857840	variable: 25K ±30%; 0.33 W
R504	6S5581	3.3K
R505	6S6320	10K
R506	18K868896	variable: 25K ±30%; 0.33 W; includes switch S501 (TCN6026AH)
	or18C857698	variable: 25K ±30%, 0.33 W (TCN6026AF)
R507	6S6336	270; 1 W
		SWITCH:
S501		dpst; p/o R506 (TCN6026AH)
	or40K80247	toggle: dpst (TCN6026AF)
S502, 503	40A80246	toggle; dpdt
		TERMINAL BOARD:
TB501	31C83826D02	35 female contacts
		LAMPHOLDER:
XDS501, 502	9B863168	miniature bayonet type
	NON-REFERENCED ITEMS	
	61B83678D01	LENS, indicator light: RED
	61B83678D02	LENS, indicator light: GRN
	3A82670A01	SCREW, machine: special type; 2 req'd (control head mounting)
	36K858652	KNOB, control: 2 req'd (VOL & SQ.)
	3A82227A02	SCREW, machine: special type; 4 req'd.
	15C82401D01	COVER, housing: (back)
	1V868494	HOUSING, control head
	13K857972	ESCUTCHEON (TCN6026AF)
	13K857976	ESCUTCHEON (TCN6026AH)
	7B82400D01	BRACKET, control head mounting
	3S7302	SCREW, machine: 10-32 x 3/8" plain hex head; 2 req'd (for mounting control head on bracket)
	3S7544	SCREW, tapping: No. 8 x 1/2" plain hex head; 3 req'd (for mounting bracket)

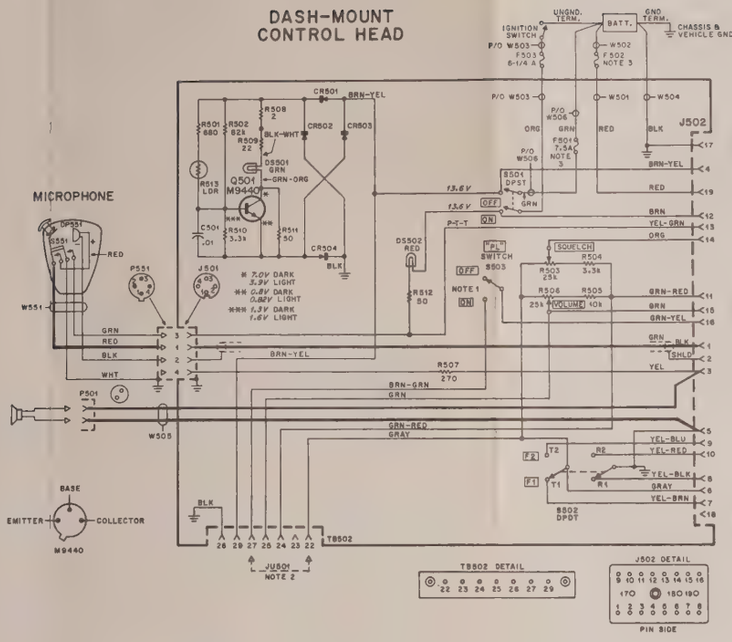


NOTES:

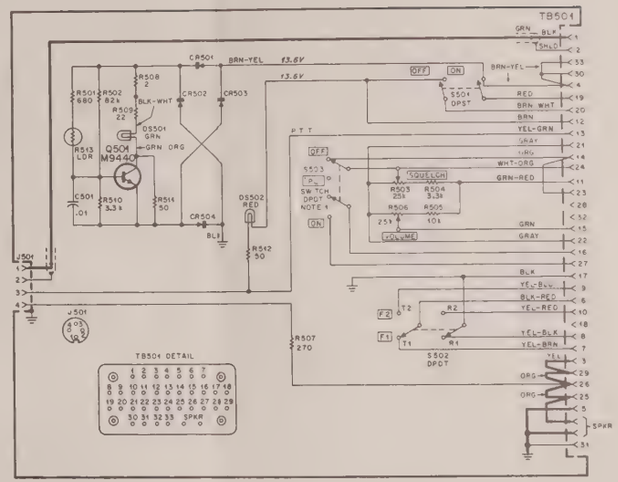
1. S503 AND ASSOCIATED WIRING USED IN "PRIVATE-LINE" MODELS ONLY.
2. JU501 USED IN "PRIVATE-LINE" MODELS ONLY.
3. DO NOT USE SLOW-BLOW FUSE.

EPS-4845-O

DASH-MOUNT CONTROL HEAD

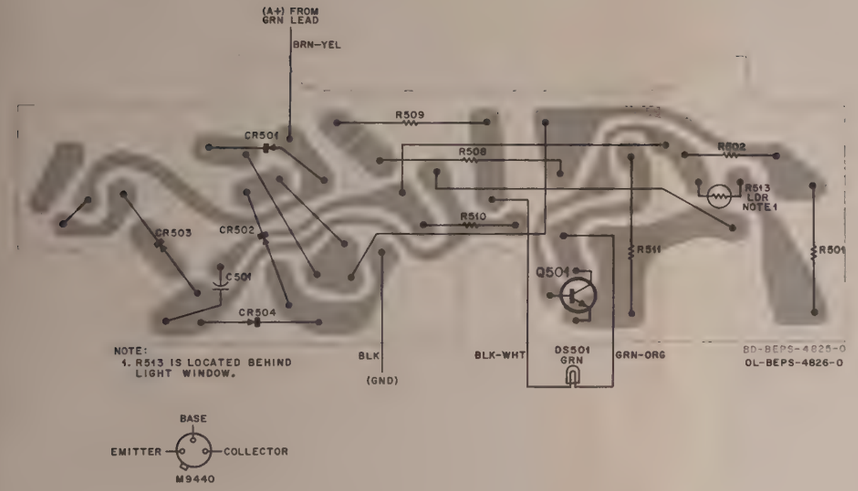


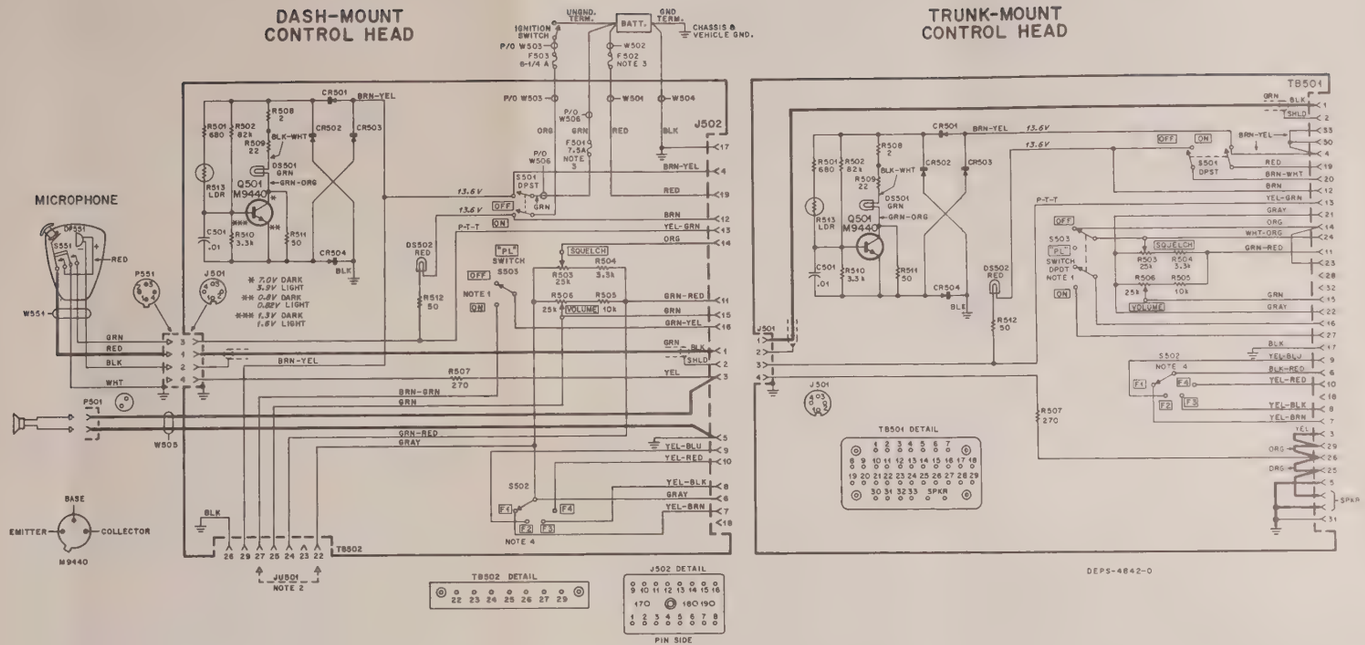
TRUNK-MOUNT CONTROL HEAD



PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

Control Heads With Dimmer Used in
2-Frequency Radio Sets
Schematic Diagram & Circuit Board Detail
Motorola No. 63P81011E44-O
8/20/75-PO





NOTES:

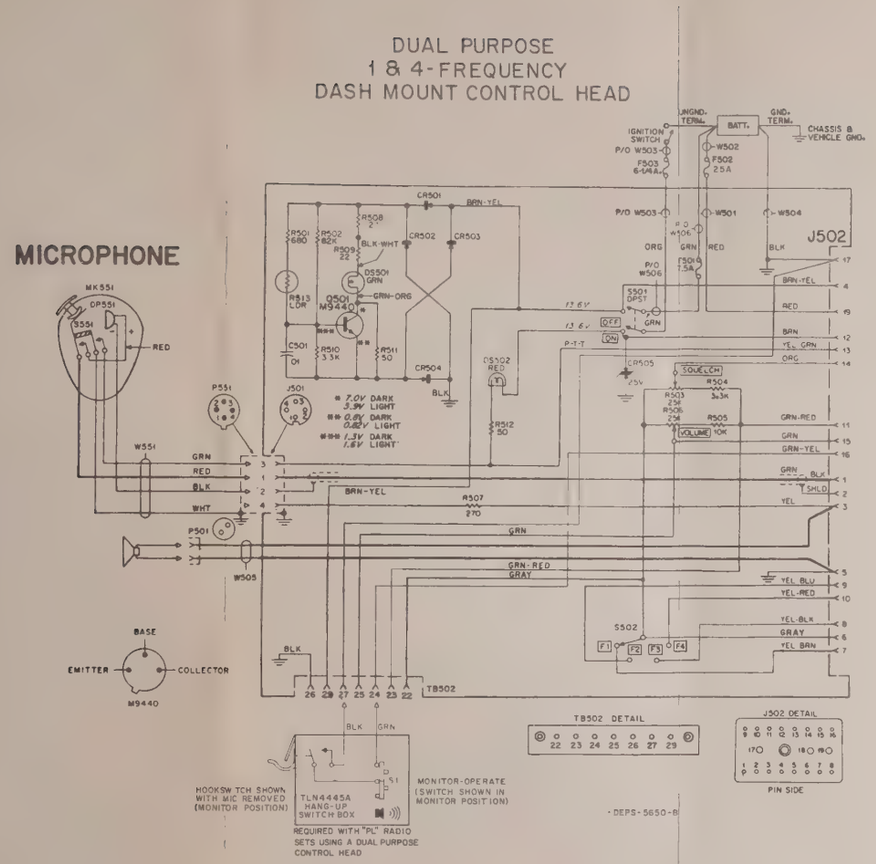
1. S503 AND ASSOCIATED WIRING USED IN "PRIVATE-LINE" MODELS ONLY.
2. J1501 USED IN "PRIVATE-LINE" MODELS ONLY.
3. DO NOT USE SLOW-BLOW FUSE
4. S502 AND ASSOCIATED WIRING USED IN MULTIPLE FREQUENCY MODEL ONLY.

EPS-4843-O

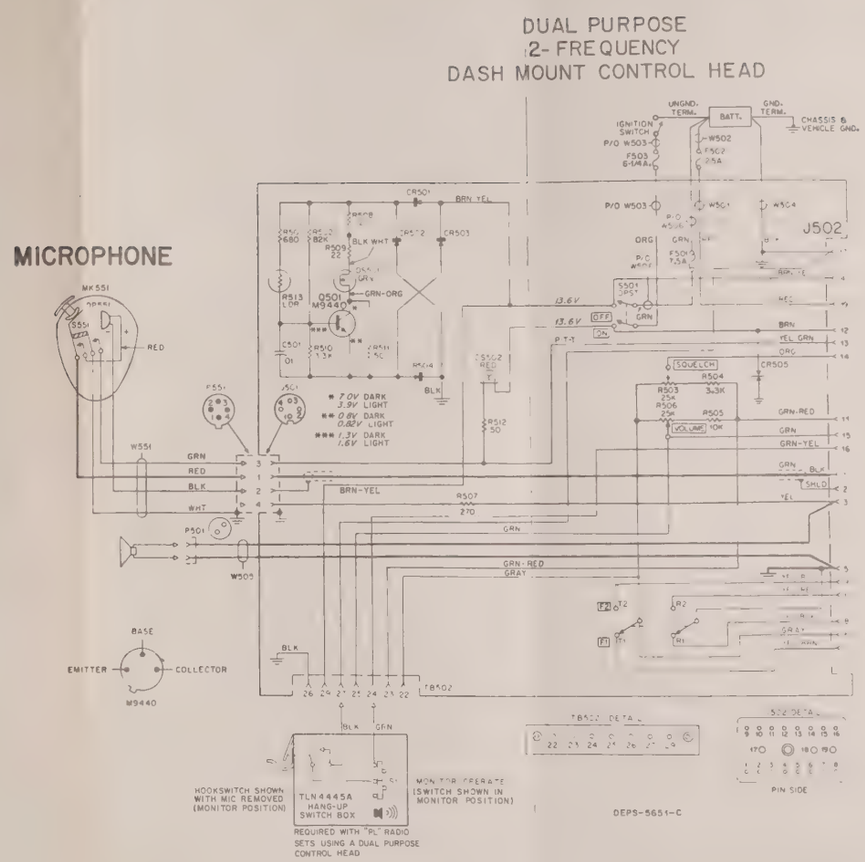
PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Control Heads With Dimmer Used in 1- & 4-Frequency Radio Sets
Schematic Diagram & Circuit Board Detail
Motorola No. 63P81011E57-O
8/20/75-PO

DUAL PURPOSE
1 & 4-FREQUENCY
DASH MOUNT CONTROL HEAD



DUAL PURPOSE
2-FREQUENCY
DASH MOUNT CONTROL HEAD



PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Dash Mount Dual-Purpose Control Heads Schematic Diagram
Motorola No. PEPS-5652-D
8/20/75-PO

REVISIONS PEPS-5652-D

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TCN6141BE-1 TCN6141BF-1 TCN6141BJ-1	CR505	Added 48-83461E45	TB501-12

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION

PARTS LIST

CONTROL HEADS

WITH DIMMER
DASH-MOUNT
1-FREQ. & 4-FREQ.

TCN6141BE (Dual Purpose, 1-Freq.)
TCN6141BJ (Dual Purpose, 4-Freq.) PL-1321-A

CR505	48-83461E45	SEMICONDUCTOR DEVICE, diode: (SEE NOTE) dual Zener type; 25 V
DS501, 502	6S4151	LAMP, incandescent: min. bay; 6-8 V; 0.2 A; type No. 51
F501	65K86099	FUSE, cartridge: 1-1/4" x 1/4"; 32 V: 7.5 A
F502	65S61682	25 A
F503	65B475247	6-1/4 A
J501	9K830418	CONNECTOR, receptacle: female; 4 contact; does not include: 4S7699 LOCKWASHER: 13/16" internal 2A482070 NUT, machine: ring type (knurled)
J502	9C801050	female; 19-contact
P501	9B855112	CONNECTOR, plug: female; 2-contact; does not include 15B855111 SHELL, connector
R503	18K857840	RESISTOR, fixed: ±10%; 1/2 W; unl stated variable: 25k ±30%; 0.33 W
R504	6S5581	3.3k
R505	6S6320	10k
R506	18K868896	variable: 25k ±30%; 0.33 W; includes switch S501
R507	6S6336	270; 1 W
R512	17D82177B05	50; 5 W
S501		SWITCH:
S502	40C83624D01	dpst; p/o R506 rotary: 1-pole; 4-position non-shorting (TCN6141BJ)
TB502	31C84922A01	BOARD, terminal: 7 terminal
W501	1V80764A18	CABLE ASSEMBLY, power: includes F501, XF501 and the following items: 10S345 CABLE, power: No. 18 ga., str.; GRN; 107" length req'd; 29K865065 LUG, ring-tongue
W502	1V80705A13	includes F502, XF502 and the following items: 30K813233 CABLE, power: No. 10 ga., str.; RED; 9-1/2 ft. length req'd
W503	1V80705A06	includes F503, XF503 and the following items: 10M343 CABLE, power: No. 18 ga., str.; ORG; 66" length req'd
W504	30K831572	CABLE, power No. 10 ga., str.; BLK, 10 ft. length req'd.
W505	30C83155H02	2-conductor; each conductor No. 18 ga., str.; 36" length req'd
XDS501, 502	9B863168	LAMPHOLDER: miniature bayonet type

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
XF501, 502, 503		FUSEHOLDER: "in-line" type; consists of: 14A82882A01 BODY 14A82883A02 CAP 42A82884A01 CLIP, contact; 2 req'd; 41A82885A01 SPRING, compression
NON-REFERENCED ITEMS		
	61B83678D01	LENS, indicator light: RED
	61B83678D02	LENS, indicator light: GRN
	3A82670A07	SCREW, machine: special type; 2 req'd (control head mounting)
	36B82629H02	KNOB, control: (2 req'd for TCN6141BE; 3 req'd for TCN6141BJ)
	26B83806D01	SHIELD, light: (for light-dependent resistor located on "dimmer" board)
	3A82227A02	SCREW, machine: special type; 4 req'd
	1V80708B72	COVER, housing: (back)
	15D83576D07	HOUSING, control head
	13D857971	ESCUTCHEON (TCN6141BE)
	13D82286C23	ESCUTCHEON (TCN6141BJ)
	3B82126B07	SCREW, nylon; 4-40 x 1/4"

MICROPHONE

TMN6013A Microphone
TMN6018A Microphone Weatherproof PL-924-C

DP551	59-82933C01 or59-82933C02	CARTRIDGE, microphone: transistor amplifier
P551	28-16370	CONNECTOR, plug: male; 4 contact
S551	40-82263G02 (TMN6013A) or40-82263G01 (TMN6018A)	SWITCH, push: dpst not replaceable: in TMN6018A: P/O W601
W551	1-80707A58 (TMN6013A)	CORD, microphone: assembly; includes P551 and the following items: 41-852707 SPRING, strain relief 29-847034 LUG, insulation-piercing; 4 required
	or1-80724A28 (TMN6018A)	CORD, PLUG & SWITCH ASSY. includes P551, S551
NON-REFERENCED ITEMS		
	1-80720A94	CASE, microphone; includes hang-up stud
	11-2506	TUBING; No. 9 BLK, 5" length required
	3-124693	LOCKSCREW: 6-32 x 1/4" Phillips round head; 2 required
	42-852710	STRAP, strain relief
	38-852699	PUSHBUTTON
	15-82701B01	COVER, microphone case (front)
	32-82703B01	GASKET: neoprene
	4-114201	WASHER: 1/4" x 0.156" x .015 3 required
	3-127924	LOCKSCREW: 6-32 x 5/16" Phillips round head
	3-132436	SCREW, machine: 6-32 x 13/16" Phillips round head 3 required
	42-82702B01	RETAINER, mic, cartridge
	1-865398	MOUNTING KIT, microphone includes 64-85596 PLATE mic. hang-up; 3-122830 SCREW, tapping: No. 8 x 1/2" slotted binder head; 2 required

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION

PARTS LIST

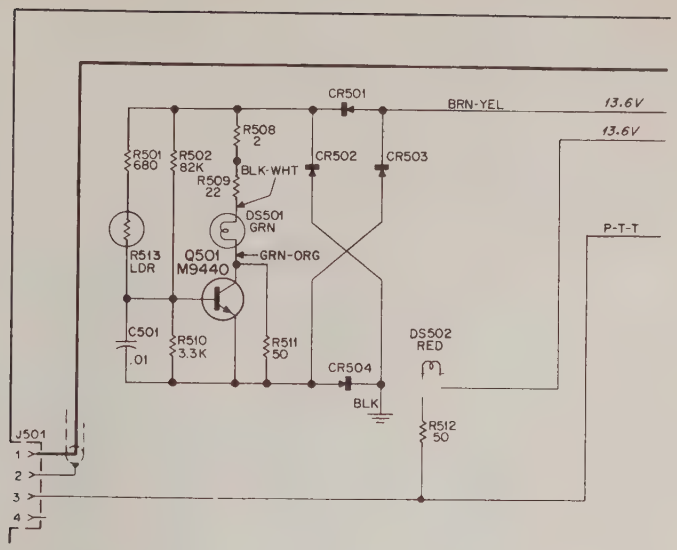
CONTROL HEADS

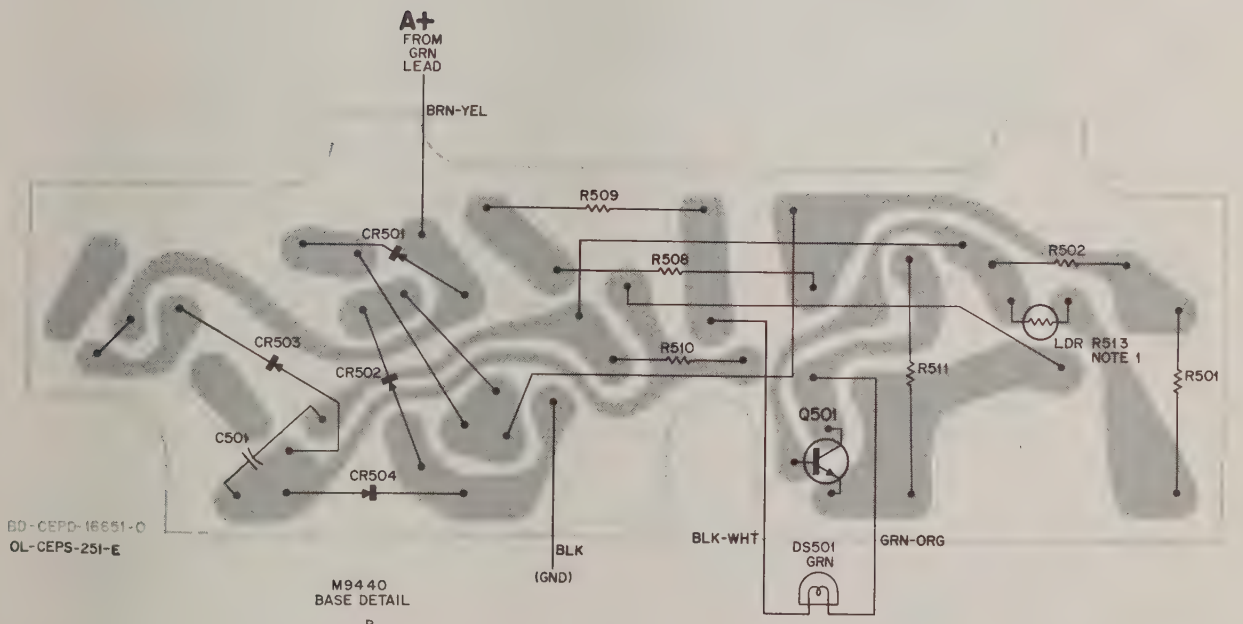
DASH MOUNT WITH DIMMER, 2-FREQUENCY

TCN6141BF (Dual Purpose) PL-1322-A

CR505	48-83461E45	SEMICONDUCTOR DEVICE, diode: (SEE NOTE) dual Zener type; 25 V
DS501, 502	6S4151	LAMP, incandescent: min. bay; 6-8 V; 0.2 A; type No. 51
F501	65K86099	FUSE, cartridge: 1-1/4" x 1/4"; 32 V: 7.5 A
F502	65S61682	25 A
F503	65B475247	6-1/4 A
J501	9K830418	CONNECTOR, receptacle: female; 4-cont; does not incl 4S7699 LOCKWASHER: 13/16" internal, 2A482070 NUT, machine: ring type (knurled)
J502	9C801050	female; 19-contact
P501		CONNECTOR, plug: incl 9B855112 CONNECTOR, plug and 15B855111 COVER, connector
R503	18K857840	RESISTOR, fixed: ±10%; 1/2 W; unl stated var; 25k ±30%; 0.33 W
R504	6S5581	3.3k
R505	6S6320	10k
R506	18C857698	var; 25k ±30%; 0.33 W
R507	6S6336	270; 1 W
R512	17D82177B05	50; 5 W
S501	40K80247	SWITCH: toggle; dpst
S502	40A80246	toggle; dpdt
TB502	31C84922A01	BOARD, terminal: 7 terminal
W501	1V80764A18	CABLE ASSEMBLY, power: incl F501, XF501 and the following items: 10S345 CABLE, power: No. 18 ga., str.; GRN; 107" length req'd 29K865065 LUG, ring tongue
W502	1V80705A13	incl F502, XF502 and the following items: 30K813233 CABLE, power: No. 10 ga, str; RED, 9-1/2 ft length req'd
W503	1V80705A06	incl F503, XF503 and the following items: 10M343 CABLE, power; No. 18 ga, str; ORG; 66" length req'd
W504	30K831572	CABLE, power: No. 10 ga, str; BLK; 10 ft. length req'd
W505	30C82155H02	2-cond; each cond. No. 18 ga, str; 36" length req'd
XDS501, 502	9B863168	LAMPHOLDER: miniature bayonet type
XF501, 502, 503		FUSEHOLDER: "in-line" type; c/o: 14A82882A01 BODY 14A82883A02 CAP 42A82884A01 CLIP, cont: 2 req'd, 41A82885A01 SPRING, compression

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
NON-REFERENCED ITEMS		
	61B83678D01	LENS, indicator light: RED
	61B83678D02	LENS, indicator light: GRN
	3A8267[illegible]	SCREW, machine: special type; 2 req'd (control heat mtg)
	36B82[illegible]	KNOB, control; 3 req'd
	26B83[illegible]D01	SHIELD, light: (for light dependent resistor located on "dimmer" board)
	3A8222[illegible]	SCREW, machine: special type; 4 req'd
	1V8070[illegible]	COVER, housing: (back)
	15D83[illegible]	HOUSING, control head
	13K85[illegible]	ESCUTCHEON
	3B82126B07	SCREW, nylon; 4-40 x 1/4"





M9440
BASE DETAIL

E = EMITTER
B = BASE
C = COLLECTOR

SHOWN FROM SOLDER SIDE

NOTES:
1. R513 IS LOCATED BEHIND LIGHT WINDOW.

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

Pilot Light Dimmer Circuit Board Detail
Motorola No. PEPS-250-G
6/9/76-PO

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

PILOT LIGHT DIMMER BOARD

1V80700B07 Light Dimmer Board PL-151-A

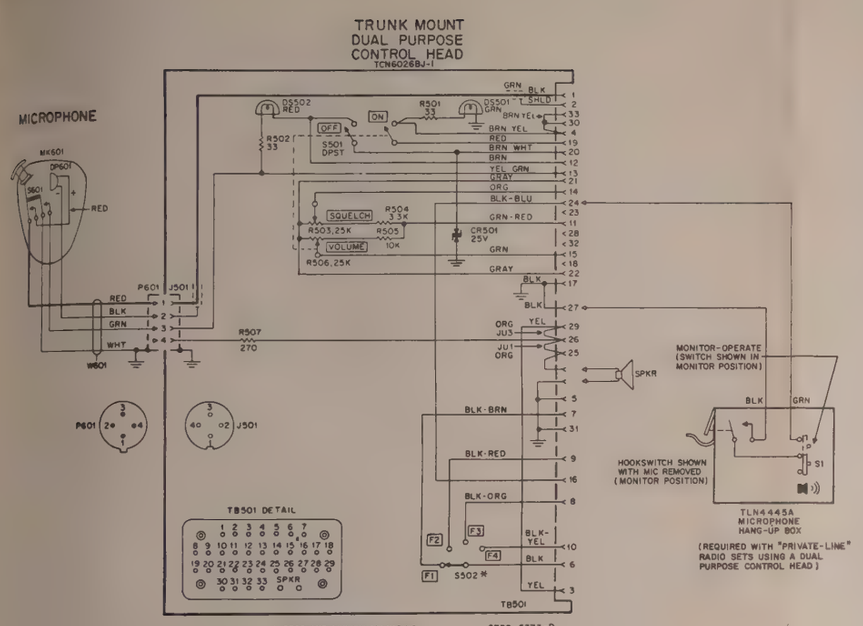
		CAPACITOR, fixed:
C501	21D82428B62	.01 uF +80-20%; 200 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR501 thru 504	48C82466H01	silicon
		TRANSISTOR,
Q501	48R869440	N-P-N; type M9440
		RESISTOR, fixed:
R501	6S6040	680 ±10%; 1/2 W
R502	6S129145	82K ±10%; 1/4 W
R508	17C82036G03	2 ±5%; 3 W
R509	17D83122D09	22 ±5%; 3 W
R510	6S129231	3.3K ±10%; 1/4 W
R511	17C82291B15	50 ±5%; 3 W
R513	6C83828D01	light dependent type; 6.4K-10K @ 25°C
NON-REFERENCED ITEM		
	1V80765A48	CIRCUIT BOARD ASSY. (less components)

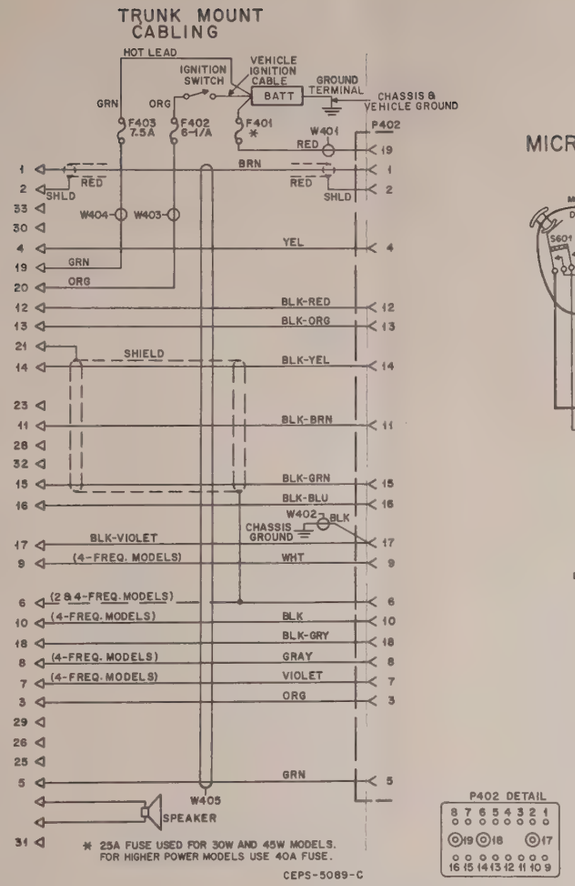
NOTE:

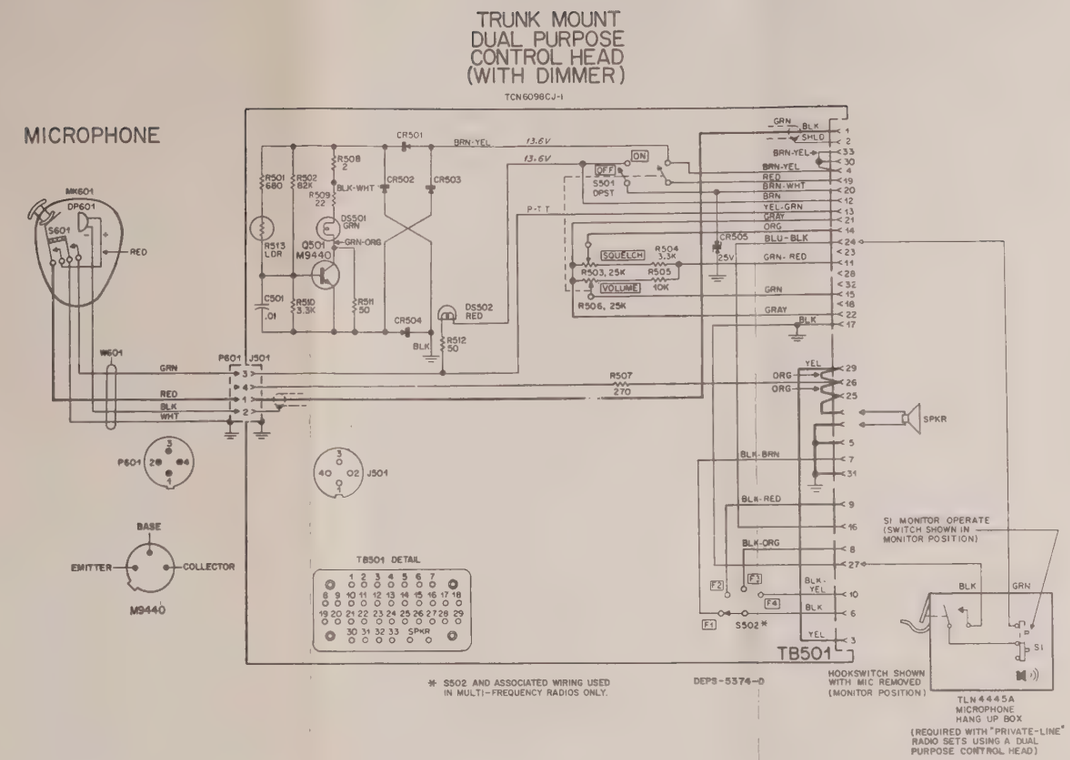
Replacement diodes must be ordered by Motorola part number only for optimum performance.

REVISIONS PEPS-250-G

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
		NOTES REVISED	







NOTES:

1. NO ELECTRICAL CONNECTION.
2. NO ELECTRICAL CONNECTION ON CARRIER SQUELCH MODELS.
3. NO ELECTRICAL CONNECTION ON 1-FREQUENCY MODELS.
4. S502 USED IN MULTI-FREQUENCY RADIOS ONLY.

EPS-5372-O

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

Trunk Mount Dual-Purpose
Control Heads and Cabling
Schematic Diagram
Motorola No. PEPS-5653-C
8/20/75-PO

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

IMPORTANT

USE ONLY THE FOLLOWING MOTOROLA PART NUMBERS WHEN ORDERING REPLACEMENT PARTS

TCN6098CE Control Head, Trunk Mount 1-Freq. Dual Purpose with Dimmer
TCN6098CF Control Head, Trunk Mount 2-Freq. Dual Purpose with Dimmer PL-1274-A

CR505	48-83461E45	SEMICONDUCTOR DEVICE, diode; (SEE NOTE) dual Zener type; 25 V
DS501, 502	6S4151	LAMP, incandescent: min. bay; 6-8 V; 0.2 A; type No. 51
J501	9K830418	CONNECTOR, receptacle: female; 4 contact; does not incl. 4S7699 LOCKWASHER; 13/16" internal 2A482070 NUT, machine ring (knurled)
R503	18K857840	RESISTOR, fixed: ±10%; 1/4 W; unl. stated variable; 25k ±30%; 0.33 W
R504	6R5581	3.3k; 1/2 W
R505	6R6320	10k; 1/2 W
R506	18K868896	variable; 25k ±30%; 0.33 W; includes SWITCH, toggle; dpst (1-freq)
	or18C857698	variable; 25k ±30%; 0.33 W (2-freq)
R507	6S6336	270; 1 W
R512	17D82177B05	50; 5 W
S501		SWITCH: p/o R506 (1-freq)
	or40K80247	toggle; dpst (2-freq)
S502	40A80246	toggle; dpdt
TB501	31C83826D01	TERMINAL BOARD: 35 female contact
XDS501, 502	9B863168	LAMPHOLDER min. bay.

NON-REFERENCED ITEMS

	26B83806D01	SHIELD, light (for R513)
	61B83678D01	LENS, indicator; light; RED
	61B83678D02	LENS, indicator; light; GRN
	3A82670A01	SCREW, control head mounting 2 req'd
	36K858652	KNOB, control; 2 req'd
	15D83576D03	HOUSING, control head
	13D857971	ESCUTCHEON, cont. hd. (1-freq.)
	13D857972	ESCUTCHEON, cont. hd. (2-freq.)

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION

PARTS LIST

1 & 2 FREQUENCY MODELS CONTROL HEAD

TCN6026BE (Trunk-Mount, 1-Freq.) Dual Purpose
TCN6026BF (Trunk-Mount, 2-Freq.) Dual Purpose PL-1231-C

CR501	48-83461E45	SEMICONDUCTOR DEVICE, diode, (SEE NOTE 1) dual Zener type; 25 V
DS501	6S-4151	LAMP, incandescent 6-8 V; .2 A; 1 cont; type No. 51
DS502	6S-4151	6-8 V; .2 A; 1 cont; type No. 51
J501	9-830418	CONNECTOR, receptacle: female; 4 cont.
R501	17-82350A04	RESISTOR, fixed; unl. stated 33 ±10%, 2 W
R502	17-82350A04	33 ±10%, 2 W
R503	18-857840	var; 25k ±10%; .33 W
R504	6-5581	3.3k ±10%; 1/2 W
R505	6-6320	10k ±10%; 1/2 W
R506	18-868896	var; 25k ±30%; .33 W; incl dpst switch; 1-freq.
	or18-857698	var; 25k ±30%; .33 W; 2 freq.
R507	6-6336	270 ±10%; 1 W
S501		SWITCH, toggle: p/o R506; 1-freq.
	or40-80247	dpst ("on-off"); 2 freq.
S502	40-80246	dpdt ("F1-F2"); 2 freq.
TB501	31-83826D02	BOARD, term: 35 female; cont term.
XDS501,	9-863168	LAMPHOLDER: min; bayonet type
XDS502	9-863168	min; bayonet type

NON-REFERENCED ITEMS

	61-865158	LENS, indicator light: RED
	61-865159	LENS, indicator light: GRN
	3-82670A01	SCREW, control head
	36-858652	KNOB, control; 2 req'd
	2-482070	NUT, ring; knurled

NOTE:

Replacement diodes must be ordered by Motorola part number only for optimum performance.

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION

PARTS LIST

4 FREQUENCY MODELS CONTROL HEAD

TCN6026BJ Control Head, Trunk Mount (Dual Purpose) PL-1232-C

CR501	48-83461E45	SEMICONDUCTOR DEVICE, diode; (SEE NOTE 1) dual Zener type; 25 V
DS501	65-4151	LAMP, incandescent: 0.2 A; type No. 51
DS502	65-4151	0.2 A; type No. 51
J501	9-830418	CONNECTOR, receptacle female; 4 contact
R501	17-82350A04	RESISTOR, fixed ±10%: unl. stated 33; 2 W
R502	17-82350A04	33; 2 W
R503	18-857840	var, 25k ±30%
R504	6-5581	3.3k; 1/2 W
R505	6-6320	10k; 1/2 W
R506	18-868896	var.; 25k ±30%; 0.33 W; incl. S501
R507	6-6336	270; 1 W
S501		SWITCH, rotary: unl. stated dpst, p/o R506
S502	40-83624D01	1 pole, 4 position
TB501	31-83826D02	BOARD, terminal 35 female contacts
XDS501	9-863168	LAMPHOLDER single contact; bayonet base
XDS502	9-863168	single contact; bayonet base

NON-REFERENCED ITEMS

	61-865158	LENS, indicator light GRN
	61-865159	LENS, indicator light RED
	2-482070	NUT, knurled; 13/64"-27 x 1/8
	3-82670A01	SCREW, machine; 6-32 x 1.44" (2 req'd)
	36-858652	KNOB, vol. control (2 req'd)
	36-82869D01	KNOB, freq. selector

NOTE

1. Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.
2. When ordering crystal units, specify carrier frequency, crystal frequency and crystal type number.

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION

PARTS LIST

IMPORTANT

USE ONLY THE FOLLOWING MOTOROLA PART NUMBERS WHEN ORDERING REPLACEMENT PARTS

MICROPHONE

TMN6013A Microphone
TMN6018A Microphone Weatherproof PL-924-C

DP551	59-82933C01 or59-82933C02	CARTRIDGE, microphone: transistor amplifier
P551	28-16370	CONNECTOR, plug: male; 4 contact
S551	40-82263G02 (TMN6013A) or40-82263G01 (TMN6018A)	SWITCH, push: dpst not replaceable; in TMN6018A; P/O W601
W551	1-80707A58 (TMN6013A)	CORD, microphone: assembly; includes P551 and the following items: 41-852707 SPRING, strain relief 29-847034 LUG, insulation-piercing; 4 required
	or1-80724A28 (TMN6018A)	CORD, PLUG & SWITCH ASSY. includes P551, S551

NON-REFERENCED ITEMS

	1-80720A94	CASE, microphone; includes hang-up stud
	11-2506	TUBING; No. 9 BLK, 5" length required
	3-124693	LOCKSCREW: 6-32 x 1/4" Phillips round head; 2 required
	42-852710	STRAP, strain relief
	38-852699	PUSHBUTTON
	15-82701B01	COVER, microphone case (front)
	32-82703B01	GASKET: neoprene
	4-114201	WASHER: 1/4" x 0.156" x .015 3 required
	3-127924	LOCKSCREW: 6-32 x 5/16" Phillips round head
	3-132436	SCREW, machine: 6-32 x 13/16" Phillips round head 3 required
	42-82702B01	RETAINER, mic. cartridge
	1-865398	MOUNTING KIT, microphone includes 64-85596 PLATE mic. hang-up; 3-122830 SCREW, tapping: No. 8 x 1/2" slotted binder head; 2 required

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION

PARTS LIST

CABLE KIT

TKN6055A Cable Kit (1-Freq., 12 V)
TKN6056A Cable Kit (2- & Multi-freq., 12 V) EPD-9982-K

F401	65-81682	FUSE, cartridge 25 amp, 32 V
F402	65-[illegible]	6-1/4 amp, 32 V
F403	65-86099	7.5 amp, 32 V
P402	1-80715A24	CONNECTOR, plug: incl: 9-801050 CONNECTOR, plug: 19-cont, female 15-82075D03 HOUSING L. H. 15-82075D01 HOUSING R. H. 3-131758 SCREW, 4-40 x 1-1/8" 2 req'd 2-129924 NUT, hex: 4-40 x 1/4", 2 req'd, 1-80717A73 SCREW & KNOB ASSY. 4-11722 WASHER, "C" 4-800671 WASHER: .016" thick 4-82113D01 WASHER: .032" thick, 42-864148 CLAMP, cable 3-132127 SCREW, tapping: No. 6 x 1/4" plain hex head
W401	1-80744A37	CABLE ASSY, special purpose incl: 30-858553 CABLE, power: 1 cond No. 12 ga, RED 22-1/2 ft. req'd 29-832116 LUG, for 3/8" stud, ref parts F401 and XF401
W402	1-[illegible]4643	incl: 30-858552 CABLE, power: 1 cond, No. 12 ga; BLK; 5-1/2 ft. req'd 29-832116 LUG, for 3/8" stud
W403	1-80[illegible]	incl: 29-824456 LUG, for No. 10 stud, 37-82603D20 SLEEVE, coded No. 20 29-82602D01 CONNECTOR, plug: 1 cont; ref part XF402
W404	1-80744A39	incl. 29-865065 LUG, for 3/8" stud 37-82603D19 SLEEVE, coded No. 19 29-82602D01 CONNECTOR, plug: 1 cont, ref part XF403
W405	30-858513 or30-864650	CABLE, special purpose: 13 cond 17 ft req'd 1-freq 17 cond 17 ft req'd 2- & multi-freq.
XF401		FUSEHOLDER, incl 14-82882A01 BODY 14-82883A01 CAP, 42-82884A01 CLIP, fuse: 2 req'd, 41-82885A01 SPRING
XF402	1-80[illegible]	incl: 14-82882A01 BODY 14-82883A01 CAP 41-82885A01 SPRING 1-80705A08 FUSE CLIP AND LEAD ASSY: incl: 42-82884A01 CLIP, fuse 10-343 LEAD, elect: 1 cond No. 18 ga; ORG, 57" req'd 1-80705A09 FUSE CLIP AND LEAD ASSY: incl. 42-82884A01 CLIP, fuse 30S10310A62 LEAD, elect 1 cond No. 18 ga; ORG; 9" req'd ref part F402
XF403	1-80[illegible]	incl: 14-82882A01 BODY 14-82883A01 CAP 41-82885A01 SPRING 1-80705A11 FUSE CLIP AND LEAD ASSY: incl: 42-82884A01 CLIP, fuse 10-345 LEAD, elect; 1 cond; No. 18 ga; GRN; 97" req'd 1-80705A12 FUSE CLIP AND LEAD ASSY: incl: 42-82884A01 CLIP, fuse 30S10310A62 LEAD elect; 1 cond, No. 18 ga; GRN, 9" req'd ref part F403

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

NON-REFERENCED ITEMS

	29-82602D01	CONNECTOR, plug, male single cont; 19 req'd
		SLEEVE,
	37-82603D01	1
	37-82603D02	2
	37-82603D03	3
	37-82603D04	4
	37-82603D05	5
	37-82603D06	6
	37-82603D07	7
	37-82603D08	8
	37-82603D09	9
	37-82603D10	10
	37-82603D11	11
	37-82603D12	12
	37-82603D13	13
	37-82603D14	14
	37-82603D15	15
	37-82603D16	16
	37-82603D17	17
	37-82603D18	18
	37-82603D21	21

NOTE:

Replacement diodes and transistors m
Motorola part number only for optimu

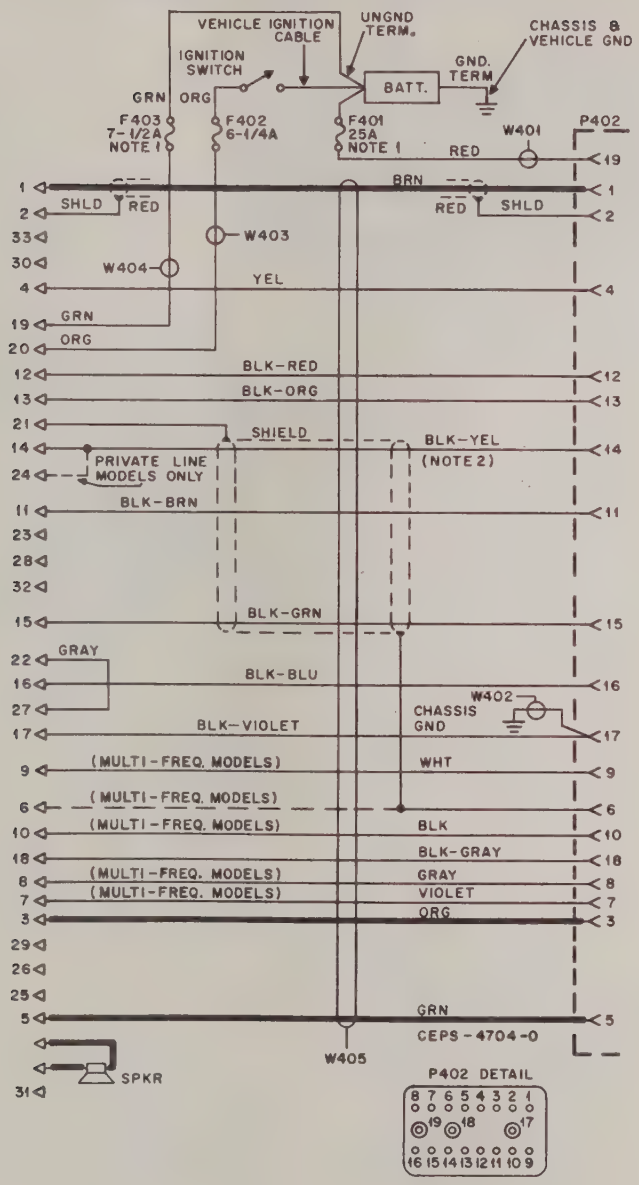
TCN6098CJ Control Head Trunk Mount 4-Frequenc
Dual Purpose with Dimmer

CR505	48-83461E45	SEMICONDUCTOR DEVICE diode; (SEE NOTE) dual Zener type; 25 V
DS501, 502	6S4151	LAMP, in min. bay, No. 51
J501	9K830418	CONNECTOR female; 4 contact 4S7699 LO internal, 2 machine, ring (kn
R503	18K857840	RESISTOR, fixed ±10%, 1/4 W unl. stated var; 25k ±30
R504	6R5581	3.3k; 1/2 W
R505	6R6320	10k; 1/2 W
R506	18K868896	var; 25k ±30
R507	6S6336	270; 1 W
R512	17D82117B05	50; 5 W
S501		SWITCH, rotary dpst (p/o R50
S502	40C83624D01	1 pole; 4 position
TB501	31C83826D01	TERMINAL B 35 female conta
XDS501, 502	9B863168	LAMPHOLDER min. bay.

NON-REFERENCED ITEMS

	61B83678D01	LENS, indicator lig
	61B83678D02	LENS, indicator
	3A82670A01	SCREW, machine (2 req'd)
	36K858652	KNOB control (2 re
	36B82869D01	KNOB, control (F1
	15C82401D01	COVER, housing
	15D83576D03	HOUSING, cont
	13D82286C23	ESCUTCHEON,

TRUNK-MOUNT CABLING



NOTES:

1. DO NOT USE SLOW-BLOW FUSE.
2. PIN NO. 14 IS CONNECTED TO TB501-14 IN CARRIER SQUELCH MODELS AND TO TB501-24 IN "PRIVATE-LINE" MODELS.

EPS-4846-O

PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Trunk Mount Cabling
Schematic Diagram
Motorola No. 63P81011E58-A
8/20/75-PO

PARTS LIST CABLE KIT

TKN6055A Cable Kit (1-Freq., 12 V)
TKN6056A Cable Kit (2- & Multi-freq., 12 V) EPD-9982-L

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		FUSE, cartridge:
F401	65-61682	25 amp; 32 v
F402	65-475247	6-1/4 amp; 32 v
F403	65-86099	7.5 amp; 32 v
		CONNECTOR, plug:
J402	1-80715A24	incl: 9-801050 CONNECTOR, plug: 19-cont; female 15-82075D03 HOUSING L. H. 15-82075D01 HOUSING R. H. 3-131758 SCREW, 4-40 x 1-1/8" 2 req'd 2-129924 NUT, hex: 4-40 x 1/4"; 2 req'd; 1-80717A73 SCREW & KNOB ASSY. 4-11722 WASHER, "C" 4-800671 WASHER: .016" thick 4-82113D01 WASHER: .032" thick; 42-864148 CLAMP, cable 3-132127 SCREW, tapping:No. 6 x 3/4" plain hex head
		CABLE ASSY, special purpose
W401	1-80744A37	incl: 30-858553 CABLE, power; 1 cond No. 12 ga; RED 22-1/2 ft. req'd 29-832116 LUG, for 3/8" stud; ref parts F401 and XF401
W402	1-864643	incl: 30-858552 CABLE, power: 1 cond; No. 12 ga; BLK; 5-1/2 ft. req'd 29-832116 LUG, for 3/8" stud
W403	1-80705A19	incl. 29-824456 LUG, for No. 10 stud 37-82603D20 SLEEVE, coded No. 20 29-82602D01 CONNECTOR, plug: 1 cont; ref part XF402
W404	1-80744A39	incl; 29-865065 LUG, for 3/8" stud 37-82603D19 SLEEVE, coded No. 19 29-82602D01 CONNECTOR, plug: 1 cont; ref part XF403
		CABLE, special purpose:
W405	30-858513 or 30-864650	13 cond 17 ft req'd 1-freq 17 cond 17 ft req'd 2- & multi-freq.
		FUSEHOLDER:
XF401		incl 14-82882A01 BODY 14-82883A01 CAP; 42-82884A01 CLIP, fuse: 2 req'd; 41-82885A01 SPRING
XF402	1-80705A07	incl: 14-82882A01 BODY 14-82883A01 CAP 41-82885A01 SPRING 1-80705A08 FUSE CLIP AND LEAD ASSY: incl: 42-82884A01 CLIP, fuse 10-343 LEAD, elect: 1 cond No. 18 ga; ORG; 57" req'd 1-80705A09 FUSE CLIP AND LEAD ASSY: incl. 42-82884A01 CLIP, fuse 30S10310A62 LEAD, elect 1 cond No. 18 ga; ORG; 9" req'd ref part F402
XF403	1-80744A38	incl: 14-82882A01 BODY 14-82883A01 CAP 41-82885A01 SPRING 1-80705A11 FUSE CLIP AND LEAD ASSY: incl: 42-82884A01 CLIP, fuse 10-345 LEAD, elect; 1 cond; No. 18 ga; GRN; 97" req'd 1-80705A12 FUSE CLIP AND LEAD ASSY: incl: 42-82884A01 CLIP, fuse 30S10310A62 LEAD elect; 1 cond; No. 18 ga; GRN; 9" req'd ref part F403

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

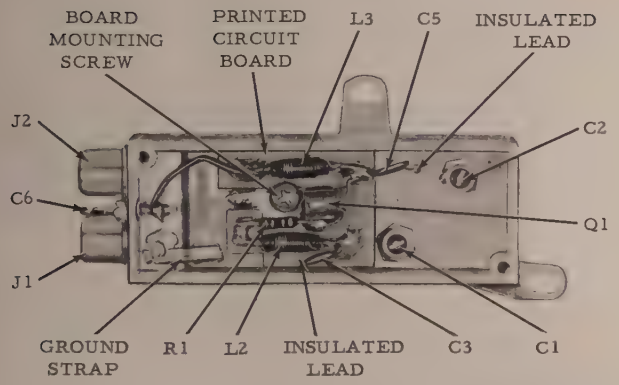
NON-REFERENCED ITEMS

	29-82602D01	CONNECTOR, plug: male; single cont; 19 req'd
		SLEEVE, coded:
	37-82603D01	1
	37-82603D02	2
	37-82603D03	3
	37-82603D04	4
	37-82603D05	5
	37-82603D06	6
	37-82603D07	7
	37-82603D08	8
	37-82603D09	9
	37-82603D10	10
	37-82603D11	11
	37-82603D12	12
	37-82603D13	13
	37-82603D14	14
	37-82603D15	15
	37-82603D16	16
	37-82603D17	17
	37-82603D18	18
	37-82603D21	21

NOTE:

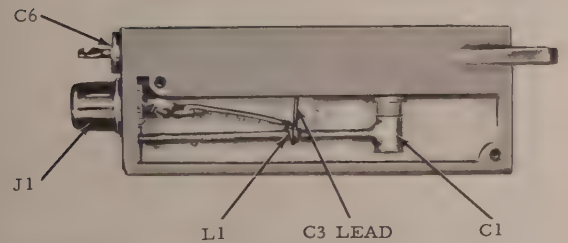
Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

TOP VIEW
(COVER PLATE REMOVED)



AEPS-4303-O

INPUT SIDE
(COVER PLATE REMOVED)



AEPS-4304-O

OUTPUT SIDE
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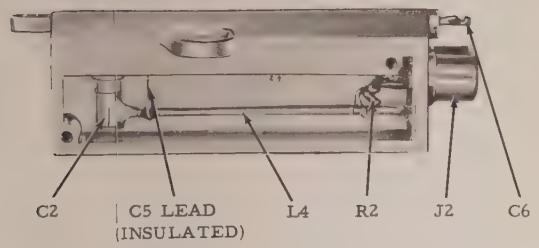
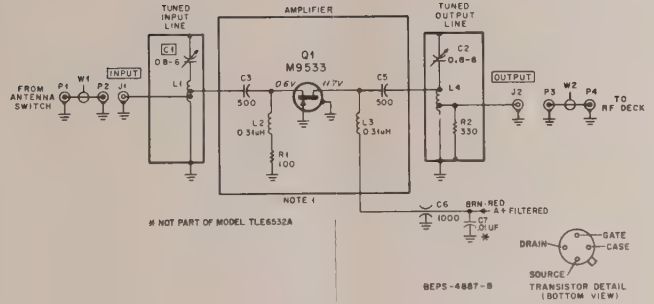


AEPS-4305-O



BEPS-4887-B

NOTES

1. ALL COMPONENTS WITHIN THIS BOX ARE PHYSICALLY MOUNTED ON PRINTED CIRCUIT BOARD.
2. REFERENCES OUTLINED BY A RECTANGLE INDICATE MARKINGS ON CHASSIS.
3. ALL CAPACITOR VALUES ARE IN pF UNLESS OTHERWISE STATED.
4. ALL VOLTAGE READINGS MEASURED WITH A 20,000 OHM-PER-VOLT MULTIMETER.

MODEL TABLE

MODEL	SUFFIX	SUB-MODEL	SUFFIX	DESCRIPTION
TLE1280A (MOBILE)		TLE6532A	1	PREAMPLIFIER
		TLN4182A		CABLE KIT
TLE1290A (BASE)		TLE6532A	1	PREAMPLIFIER
		TLN4372A		CABLE KIT

EPS-3050-A

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

RF Preamplifier
Schematic Diagram
Motorola No. 63P81011E47-D
8/20/75-PO

REVISIONS

63P81011E47-D

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION	REFER TO CIRCUIT BOARD
TLN4477A	C7	ADDED 21K832501, .01 uF +60-40%, 250 V	BETWEEN A4 AND GROUND	None.
	NON-REF.	ADDED 39B84680B01, SPRING, CONTACT	PARTS LIST	

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION

PARTS LIST

TLN4477A Cable & Hardware Kit — PL-1197-A

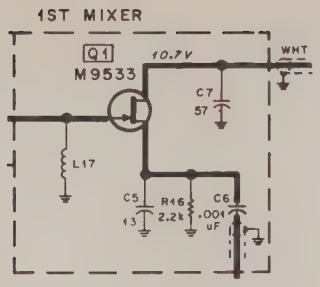
		CAPACITOR, fixed
C7	21K832501	.01 uF +60-40%; 250 V
		CONNECTOR, plug:
P1	28B82331G01	male; coaxial; miniature type
P2	28B82331G01	male; coaxial; miniature type
P3	28B82331G01	male; coaxial; miniature type
P4	28B82331G01	male; coaxial; miniature type
		LINE, RF transmission:
W1	1V80716B13	includes P1, P2 and 30B83794C01 CABLE, RF: coaxial; 8" length req'd.
W2	1V80716B13	includes P3, P4 and 30B83794C01 CABLE, RF: coaxial; 8" length req'd.
	NON-REFERENCED ITEMS	
	7C84510C01	BRACKET, preamp. mtg.
	3S134212	SCREW, tapping: No. 4-40 x 5/16"; 5 req'd.
	42S10217A02	STRAP, cable harness
	39B84680B01	SPRING, contact

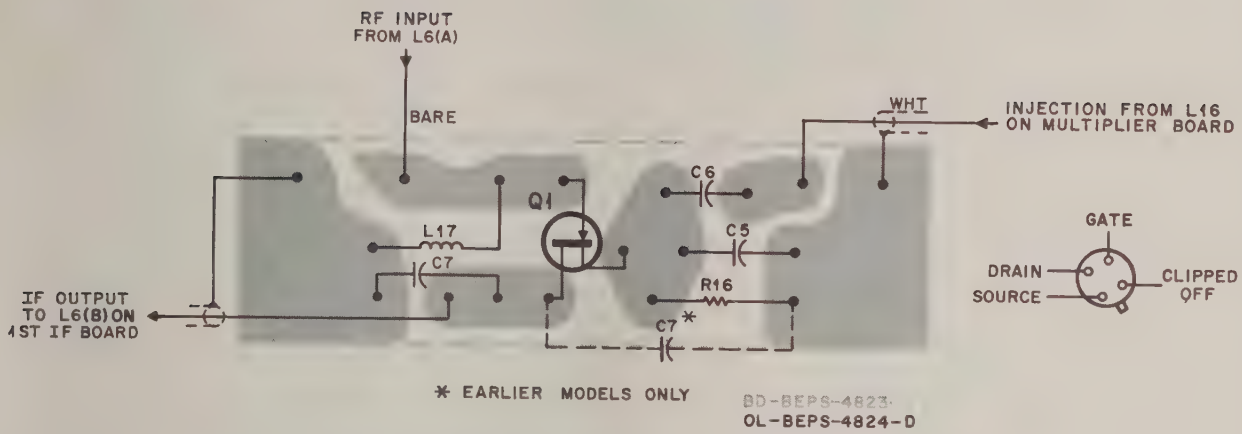
TLE6532A Preamplifier Chassis — PL-738-B

		CAPACITOR, fixed; pF: unl. stated
C1, 2		includes: 20C83693H01 CAPACITOR, variable; 0.8-6 and 76A84425B01 PISTON, tuning
C3	21K861441	500 ±10%; N4700
C5	21K861441	500 ±10%; N4700
C6	21B861219	.001 uF +100-0%; 500 V, coded RED
		CONNECTOR, receptacle:
J1, 2	9C84135B01	female; single contact
		COIL, RF:
L1	47B84330B01	line input
L2	24A800484	choke, 0.31 uH
L3	24A800484	choke, 0.31 uH
L4	47B84330B03	line output
		TRANSISTOR: (SEE NOTE)
Q1	48R869533	field-effect "N Channel" type M9533
		RESISTOR, fixed:
R1	6S131524	100 ±10%; 1/4 W
R2	6S185B73	330 ±10%; 1/8 W
	NON-REFERENCED ITEMS	
	1V80708B85	CIRCUIT BOARD ASSEMBLY
	15B84322B01	COVER, top
	15B84323B01	COVER, side: 2 req'd.
	3S129481	SCREW, machine: #4-40 x 1/4" "Phillips" binder head
	15C84321B01	HOUSING, preamplifier
	14B82643E19	INSULATOR, Armite paper
	42B83660C01	CLIP, transistor mtg.
	76A84425B01	CORE, tuning: 2 req'd
	3S490352	SCREW, machine: No. 2-56 x 5/32" (cover mounting screws)

NOTE:

Replacement transistor must be ordered by Motorola part number only for optimum performance





TLE6583A RF DECK

SHOWN FROM SOLDER SIDE

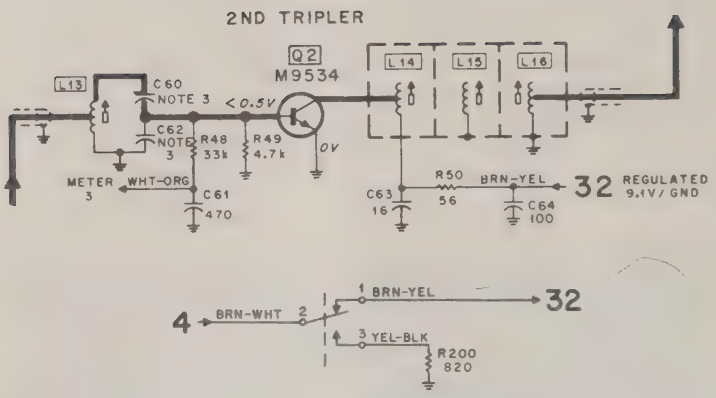
REVISIONS

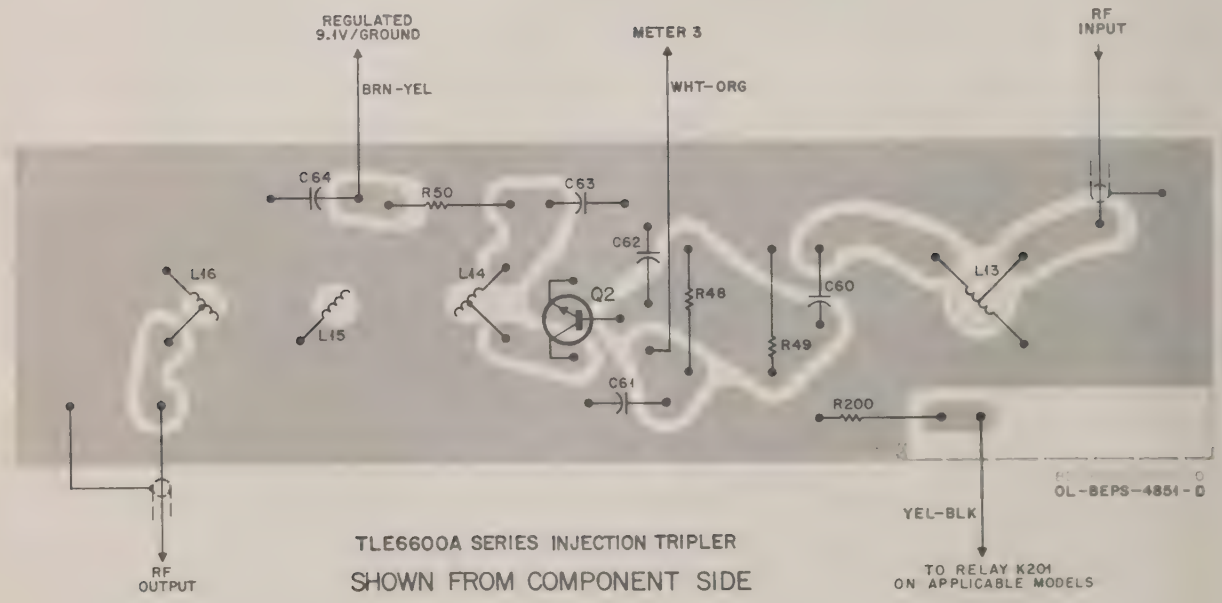
PEPS-4841-C

BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLE6583A	C7	WAS 22 pF ±5%; NP0 AND CONNECTED AS SHOWN.	

PARTS LIST SHOWN ON BACK OF
TRANSMITTER-RECEIVER
SCHEMATIC & INTERCABLING DIAGRAM

Model TLE6583A RF Deck
Circuit Board Detail
Motorola No. PEPS-4841-C
6/9/76-PO





TLE6600A SERIES INJECTION TRIPLER
SHOWN FROM COMPONENT SIDE

PARTS LIST SHOWN ON BACK OF
TRANSMITTER-RECEIVER
SCHEMATIC & INTERCABLING DIAGRAM

TLE6600A Series Injection Tripler
Circuit Board Detail
Motorola No. PEPS-4852-C
6/9/76-PO

"DIGITAL PRIVATE-LINE" ENCODER-DECODER

MODEL TLN5817A & TLN5817AV

PERFORMANCE TESTS

If the decoder is operating properly, a 0.18 microvolt rf carrier modulated ±0.5 to 1 kHz with the appropriate code should unsquelch the receiver. This can be checked as follows:

(1) Connect the rf signal generator output to the radio set antenna jack and set the generator output level to minimum.

(2) Modulate the signal generator ±0.5 kHz with the appropriate "Digital Private-Line" code. The modulating signal can be obtained from a Motorola Model SLN6413A "Digital Private-Line" Test Set. The signal generator must have an external modulation frequency response of less than 1 Hz. The Motorola Model S1318A Signal Generator or S1327B Service Monitor have the required low frequency response.

(3) Also modulate the signal generator with a 300 to 3000 Hz tone. Total deviation should be ±4 kHz, including code modulation.

(4) Increase the signal generator output level until the receiver unsquelches. No more than 0.18 uV should be needed to unsquelch the receiver.

The encoder should modulate the transmitter rf carrier ±0.5 to 1 kHz. The transmitted signal should unsquelch any properly-operating receiver that is equipped with the same coded squelch code and is operating in the coded squelch mode. After the microphone PTT button is released, the transmitter should remain keyed for about 180 milliseconds and the encoder should produce a turn-off code. No squelch tails should be heard in properly operating coded squelch receivers. Validity of the coded squelch code and turn-off code can be checked with a Motorola SLN6413A "Digital Private-Line" Test Set.

68P81025E69-D
(Sheet 1 of 2)
3/22/76-UP

"DIGITAL PRIVATE-LINE" ENCODER-DECODER TROUBLESHOOTING CHART

SYMPTOM	PROBABLE CAUSE	CIRCUIT CHECKS
Transmitter has no power output. Transmit relay doesn't operate.	No A+ from PTT delay circuit.	1. Check PTT switch circuit. 2. Check PTT delay circuit.
Transmitter causes squelch tails in "Digital Private-Line" receivers.	Turn-off code not being sent, or is of insufficient duration or deviation.	1. Check turn-off code deviation: should be ±500 to ±1000 Hz. Turn-off code should begin as soon as PTT button is released. Transmitter should remain keyed for 160 to 250 msec after PTT button is released. 2. Check PTT delay circuit. 3. Check U801-9: should be 0 V during delayed PTT. 4. Check Q821: must be off for proper low-pass filter operation during transmit.
Transmitter cannot unsquelch "Digital Private-Line" receivers.	Insufficient transmitter code deviation.	Check code deviation: should be ±500 to ±1000 Hz.
	Incorrect or faulty code.	1. Check U801-15 through U801-23 for proper octal code. 2. Check U801-9: should be +6 V (high).
	Encoder filter is malfunctioning.	Check encoder filter (Q801-803 and Q821) for proper operation.
	50 kHz oscillator is malfunctioning.	Check U801-4 for 50 kHz square wave. Rise time should be 750 nsec or less.
Receiver will not unsquelch in "Digital Private-Line" operation.	Switch interface circuits are malfunctioning.	Check switch interface circuits (Q805 and Q806). Q806 emitter should be 12.8 V when U801-7 is high.
	U801 is not decoding properly.	1. Check U801-7: should be 6 V when decoding a valid code. 2. Check U801-1: should be 0 V. 3. Check U801-12 with oscilloscope. You should see 6 V p-p pulses 1.84 msec apart.
	50 kHz oscillator malfunctioning.	Check U801-4 for 50 kHz square wave. Rise time should be 750 nsec or less.
	U801 is not properly programmed.	Check U801-15 through U801-23 for proper octal code.
	U801 is in encode mode.	Check U801-9: should be low.
	Decoder filter and data conditioner malfunctioning.	Compare waveforms and voltages with those on the schematic diagram.
Excessive decoder falsing.	Decoder low-pass filter malfunctioning.	Check decoder filter response. At Q812 emitter the filter response should be -1 to -4 dB at 134 Hz and -12 to -15 dB at 250 Hz. Keep input signal below 400 mV p-p to keep CR803 and CR804 out of clip.
	Encoder-decoder U801 malfunctioning.	Check U801-7: should be low when no code is decoded.
	U803C in current source is on.	Check U803-9: should be 10.0 V when U801-7 is low.
Excessive blocking.	Decoder filter malfunctioning.	Check decoder filter response. See checks for excessive decoder falsing.
	Current source malfunctioning.	Check U803-9: should be 0.1 V when U801-7 is high.
Squelch open at all times in "Digital Private-Line" mode.	Switch interface circuit malfunctioning.	Check switch interface circuits (Q805 & Q806).
	U801 malfunctioning.	Check U801-7: should be 6 V except when valid code is decoded.
	Power supply voltage is not 6.2 V ± .5 V.	Check voltage at U801-24.
	50 kHz oscillator operating intermittently or at wrong frequency.	Check 50 kHz clock signal at U801-4: should be 50 kHz square wave. Rise time should be 750 nsec or less.

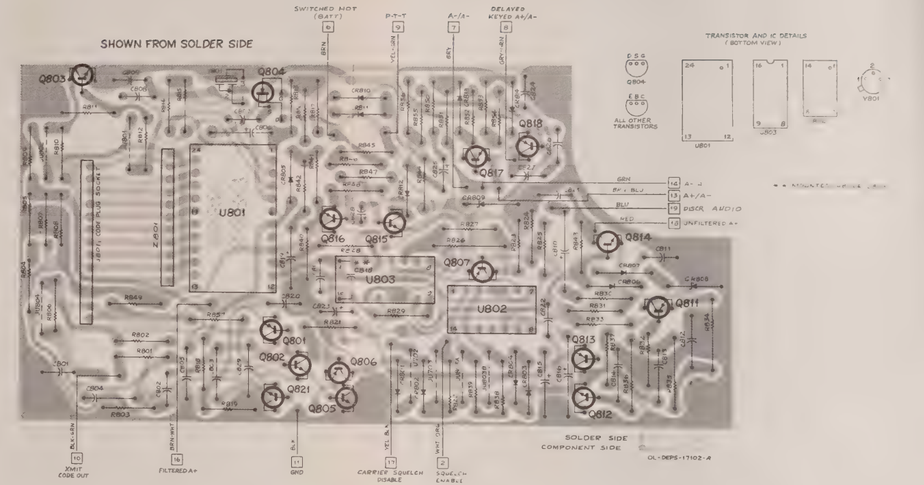
PARTS LIST

TLN5817A & TLN5817AV Encoder-Decoder Board Pt. 31x5-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF ±5%; 50 V unless otherwise stated
C801, 820, 821, 822, 824, 826, 827	21-82428B59	.01 +80-20%; 200 V
C802, 811, 817	21-82187B20	.001 ±10%; 100 V
C803	8-83813H26	.0056
C804	8-83813H24	.036
C805	8-83213H14	.043
C806, 819	23-84762H07	4.7 ±20%; 10 V
C807	21-82428B09	.0047 ±10%; 100 V
C808	21-840849	20 pF; NPO
C809	21-83798B01	100 pF; 200 V
C810	23-82783B36	39 ±10%; 10 V
C812	8-82905G39	.023
C813	8-83813H23	.068
C814	8-83813H19	.0039
C815	23-84762H03	10 ±10%; 20 V
C816	23-82783B48	0.68; 35 V
C818	21-82187B14	.001 ±10%; 100 V
C823, 825	23-84538G04	15 ±20%; 20 V
C828	23-84538G01	1 ±20%; 35 V
C829	8-83813H27	.0033
		DIODE: (SEE NOTE)
CR801, 802, 805, 806, 807, 812, 813	48-83654H01	silicon
CR803, 804	48-84616A01	hot carrier
CR808	48-82256C11	Zener type; 10 V
CR809	48-83696E07	Zener type; 6.2 V
CR810, 811, 814	48-82464H13	silicon
		SOCKET:
J801	9-82071K01	female; 12 contact
		TRANSISTOR: (SEE NOTE)
Q801, 806, 807, 811, 813, 816, 817	48-869643	PNP; type M9643
Q802, 805, 812, 815, 821	48-869642	NPN; type M9642
Q803	48-869642	NPN; type M9642 (TLN5817AV only)
Q804	48-869648	field-effect
Q814	48-869648	NPN; type M9648
Q818	48-869649	PNP; type M9649
		RESISTOR, fixed: ±5%; 1/4 W; unless otherwise stated
R801	6-124A74	11k
R802, 844	6-124A37	330
R803, 853	6-124A49	1k
R804, 805, 808, 813	6-124A97	100k
R806, 854	6-124A45	680
R807, 831	6-124B02	150k
R809	6-124A91	56k
R810	6-124A73	10k (TLN5817AV only)
R811, 812	6-124A89	47k (TLN5817AV only)
R814	6-124B04	180k
R815, 827	6-124B14	470k
R816	6-124A77	15k
R817	6-124B08	270k
R818, 841	6-124C99	120k ±10%
R819, 840, 842	6-124C95	82k ±10%
R820, 821	6-124C89	47k ±10%
R822	6-124C59	2.7k ±10%
R823, 830, 848	6-124A83	27k
R824, 829, 838, 839, 845, 846	6-124A73	10k
R825	6-124A59	2.7k
R826	6-10621D80	56.2k ±1%; 1/8 W
R829, 833, 847	6-124A89	47k
R832	6-124A93	68k
R834, 835, 836	6-13755D64	56.2k ±1%
R837	6-124A55	1.8k
R843	6-124A33	220
R849, 852, 859	6-124C75	12k ±10%
R850, 855	6-124A53	1.5k
R851	6-124A79	18k
R856	6-124C57	2.2k ±10%

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		INTEGRATED CIRCUIT: (SEE NOTE)
U801	51-84267A82	type M6782
U802	51-84320A55	type LM565CN
U803	51 84320A79	type CA3096AE
		NETWORK:
Z801	51-82142K02	resistive-transistive network assembly
	or 1-80772B36	
		CRYSTAL:
Y801	48-82003K01	resonator 50.00000-50.000000KH
NON-REFERENCED ITEMS:		
	39-10184A24	CONTACT, chain form
	37-82603D02	SLEEVING, coded #2
	37-82603D06	SLEEVING, coded #6
	37-82603D07	SLEEVING, coded #7
	37-82603D08	SLEEVING, coded #8
	37-82603D09	SLEEVING, coded #9
	37-82603D10	SLEEVING, coded #10
	37-82603D11	SLEEVING, coded #11
	37-82603D13	SLEEVING, coded #13
	37-82603D14	SLEEVING, coded #14
	37-82603D16	SLEEVING, coded #16
	37-82603D17	SLEEVING, coded #17
	37-82603D18	SLEEVING, coded #18
	37-82603D19	SLEEVING, coded #19

NOTE: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

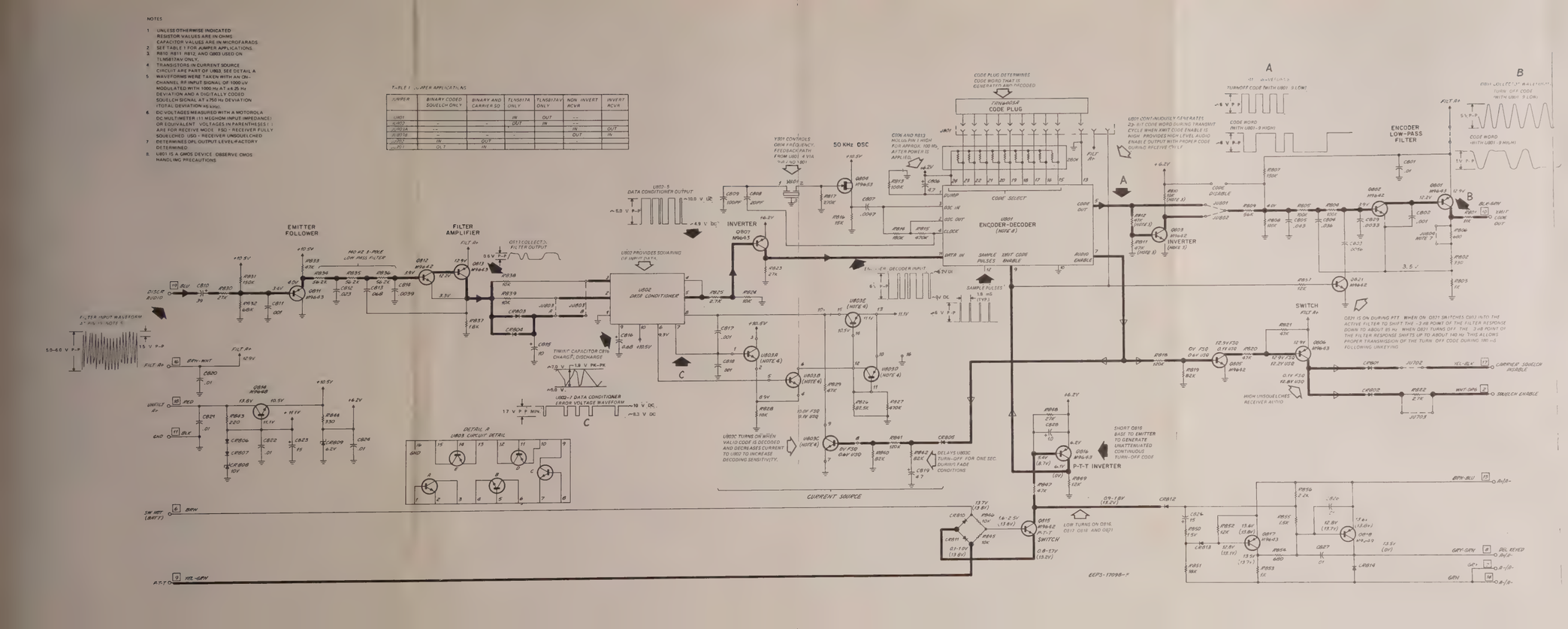


"DIGITAL PRIVATE-LINE" ENCODER-DECODER

MODELS TLN5817A & TLN5817AV

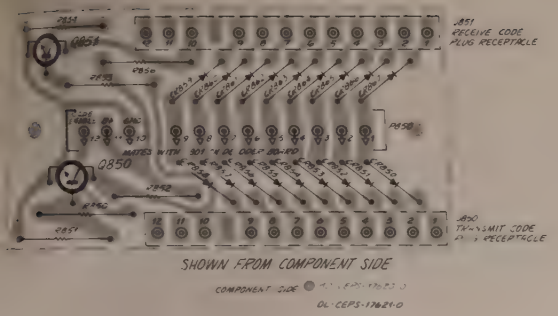
FUNCTION--

Used as a code generator and decoder in "CONSOLETTE" Base Stations and "MOCOM 70"® Mobiles. Generates and decodes 23-bit binary code word in "Digital Private-Line" squelch systems.


NOTES
1 UNLESS OTHERWISE INDICATED: RESISTOR VALUES ARE IN OHMS; CAPACITOR VALUES ARE IN MICROFARADS.
2 SEE TABLE 1 FOR JUMPER APPLICATIONS.
3 R810, R811, R812, AND Q803 USED ON TLN5817AV ONLY.
4 TRANSISTORS IN CURRENT SOURCE CIRCUIT ARE PART OF U802. SEE DETAIL A.
5 WAVEFORMS WERE TAKEN WITH AN ON-CHANNEL RF INPUT SIGNAL OF 1000 uV MODULATED WITH 1000 Hz AT ±6.25 Hz DEVIATION AND A DIGITALLY CODED SQUELCH SIGNAL AT ±750 Hz DEVIATION (TOTAL DEVIATION ±6 kHz).
6 DC VOLTAGES MEASURED WITH A MOTOROLA DC MULTIMETER (11 MEGOHM INPUT IMPEDANCE) OR EQUIVALENT. VOLTAGES IN PARENTHESES ( ) ARE FOR RECEIVE MODE. FSO - RECEIVER FULLY SQUELCHED. USO - RECEIVER UNSQUELCHED.
7 DETERMINES DPL OUTPUT LEVEL-FACTORY DETERMINED.
8 U801 IS A CMOS DEVICE. OBSERVE CMOS HANDLING PRECAUTIONS.
TABLE 1 - JUMPER APPLICATIONS
JUMPER | BINARY CODED SQUELCH ONLY | BINARY AND CARRIER SQ | TLN5817A ONLY | TLN5817AV ONLY | NON INVERT RCVR | INVERT RCVR
J801 | | | IN | OUT | -- | --
J802 | -- | -- | OUT | IN | -- | --
J802A | -- | -- | -- | -- | IN | OUT
J802B | -- | -- | -- | -- | OUT | IN
J803 | IN | OUT | -- | -- | -- | --
J804 | OUT | IN | -- | -- | -- | --
EMITTER FOLLOWER
FILTER AMPLIFIER
FILTER INPUT WAVEFORM
300-3K 2-POLE LOW PASS FILTER
OFF-COLLECTOR FILTER OUTPUT
U802 DATA CONDITIONER
U802 PROVIDES SQUARING OF INPUT DATA
TIMING CAPACITOR C815 CHARGE/DISCHARGE
U802-7 DATA CONDITIONER ERROR VOLTAGE WAVEFORM
DETAIL A U803 CIRCUIT DETAIL
INVERTER
50 KHz OSC
Y801 CONTROLS OSC FREQUENCY. FEEDBACK PATH FROM U801 4 VIA 5 AND 1 TO 1801
CODE PLUG DETERMINES CODE WORD THAT IS GENERATED AND DECODED
TONE/DCSA CODE PLUG
U801 CONTINUOUSLY GENERATES 23-BIT CODE WORD DURING TRANSMIT CYCLE WHEN XMIT CODE ENABLE IS HIGH. PROVIDES HIGH LEVEL AUDIO ENABLE OUTPUT WITH PROPER CODE DURING RECEIVE ONLY
C806 AND R813 MOLDS PIN 1 HIGH FOR APPROX. 100 MS AFTER POWER IS APPLIED
CODE SELECT
ENCODER-DECODER (NOTE 6)
CODE DISABLE
INVERTER (NOTE 3)
ENCODER LOW-PASS FILTER
TURNOFF CODE (WITH U801 9 LOW)
CODE WORD (WITH U801 9 HIGH)
TURN-OFF CODE (WITH U801 9 LOW)
SAMPLE PULSES
SWITCH
Q821 IS ON DURING PTT. WHEN ON, Q821 SWITCHES C821 INTO THE ACTIVE FILTER TO SHIFT THE -3 dB POINT OF THE FILTER RESPONSE DOWN TO ABOUT 85 Hz. WHEN Q821 TURNS OFF, THE -3 dB POINT OF THE FILTER RESPONSE SHIFTS UP TO ABOUT 140 Hz. THIS ALLOWS PROPER TRANSMISSION OF THE TURN-OFF CODE DURING 180 ±5 FOLLOWING UNKEYING.
HIGH UNSQUELCHES RECEIVER AUDIO
CARRIER SQUELCH INVERTED
SQUELCH ENABLE
SHORT Q816 BASE TO EMITTER TO GENERATE UNATTENUATED CONTINUOUS TURN-OFF CODE
P-T-T INVERTER
DELAYS U803C TURN-OFF FOR ONE SEC. DURING FADE CONDITIONS
U803C TURNS ON WHEN VALID CODE IS DECODED AND DECREASES CURRENT TO U802 TO INCREASE DECODING SENSITIVITY.
CURRENT SOURCE
LOW TURNS ON Q816, Q817, Q818, AND Q821
P-T-T SWITCH
EEPS-17098-F
THEORY OF OPERATION DATA
MAINTENANCE DATA
PRIMARY SIGNAL FLOW
CONTROL SIGNAL PATH

"DIGITAL PRIVATE-LINE" ENCODER-DECODER

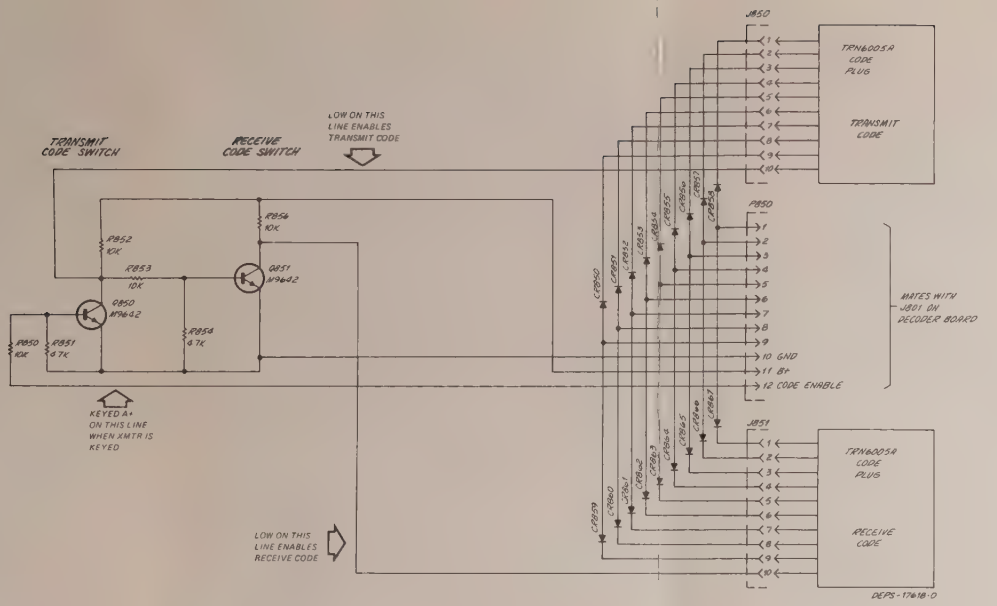
68P81025E69-D
(Sheet 2 of 2)
3/22/76-UP



SHOWN FROM COMPONENT SIDE

COMPONENT SIDE

DL-CEPS-17624-O



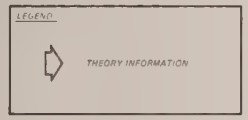
REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION

PARTS LIST

TLN5730A 2-Code Adapter Board PL-3414-O

CR850 thru 857	48-83654H01	DIODE: (SEE NOTE) silicon
J850, 851	9-82071K01	CONNECTOR, receptacle: female; 12-contact
P850		CONNECTOR, plug: consists of: 28-82070K01 CONTACT, male; 13 req'd.
Q850, 851	48-869642	TRANSISTOR: (SEE NOTE) NPN; type M9642
R850, 852, 853, 856	6-124A73	RESISTOR, fixed: 10k ±5%; 1/4 W
R851, 854	6-124A65	4.7k ±5%; 1/4 W
NON-REFERENCED ITEMS		
	1V80769B88	CIRCUIT BOARD ASSY., incl. referenced item P850
	3-13x804	SCREW, machine: 4-40 x 5/16; 2 req'd.

NOTE: For optimum performance, diodes and transistors must be ordered by Motorola part number.



APPLICATION -

Plugs into code plug receptacle on "Digital Private-Line" Decoder or Encoder-Decoder to allow separate digital "Private-Line" codes for transmit and receive. Code plugs for the two codes then plug into the receptacles on the two-code adapter board.

Model TLN5730A "Digital Private-Line" Two-Code Adapter Schematic Diagram and Circuit Board Detail
Motorola No. 68P81106E97-A
8/20/75-PO

TONE "PRIVATE-LINE" ENCODER-DECODER

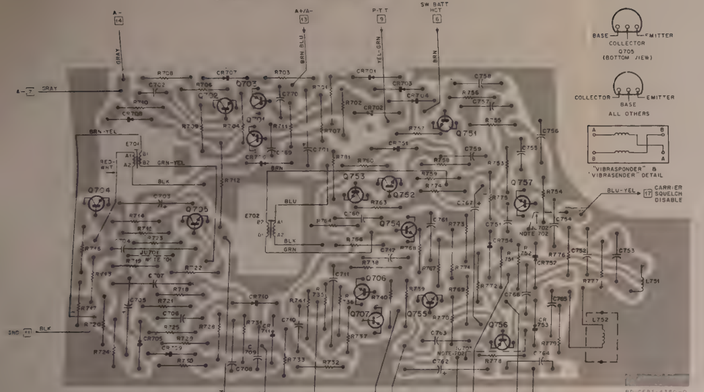
MODEL TLN4448A

FUNCTION

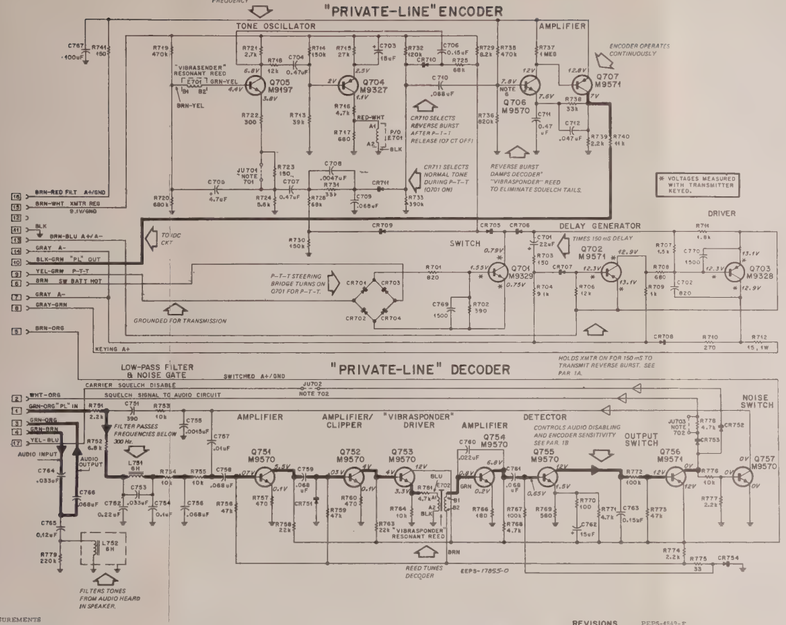
Encodes and decodes subaudible tones which permit only properly coded audio to be heard in speaker.

"PL" ENCODER-DECODER

SHOWN FROM SOLDER SIDE

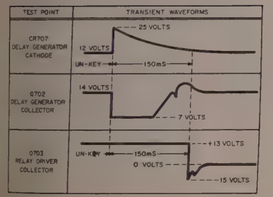


GL-CEPS-4379-E



NOTES:
701. DETERMINES TONE OUTPUT LEVEL. FACTORY DETERMINED.
702. THE RADIO IS SHIPPED WITH JUMPER JU702 OUT AND JU703 IN. IN THIS MODE THE "PL" SQUELCH SENSITIVITY IS TIED TO THE CARRIER SQUELCH SENSITIVITY. THUS THE "PL" SQUELCH SENSITIVITY IS VARIABLE WITH SQUELCH CONTROL. IF DESIRED, THE RADIO CAN BE WIRED SO THE "PL" SQUELCH SENSITIVITY IS INDEPENDENT OF CARRIER SQUELCH CONTROL. TO ACCOMPLISH THIS, INSERT JUMPER JU702 AND REMOVE JUMPER JU703.
703. UNLESS OTHERWISE STATED, ALL CAPACITOR VALUES ARE IN MICROFARADS, RESISTOR VALUES ARE IN OHMS, ALL RESISTORS ARE 1/4 WATT.
704. DC VOLTAGES TAKEN WITH 20K OHMS PER VOLT MULTIMETER WITH RESPECT TO GROUND.

* VOLTAGES MEASURED WITH TRANSMITTER KEYED.



AEPS-3137-O

TABLE I.

"PRIVATE-LINE" ENCODER MEASUREMENTS

METERING POINT	TYPICAL AUDIO VOLTAGES
Tone Oscillator, Q704, Base	180 mV rms
Tone Oscillator, Q704, Collector	1.2 V rms
Across Reed Primary, B1 to B2	60 mV rms
Across Reed Secondary, A1 to A2	100 mV rms
Tone Oscillator, Q705, Base	0.85 V rms
Tone Oscillator, Q705, Collector	0.4 V rms
Tone Oscillator, Q705, Emitter	0.85 V rms
PL Amplifier, Q706, Base	35 V rms
PL Amplifier, Q706, Emitter	35 V rms
PL Amplifier, Q706, Collector	25 mV rms
PL Amplifier, Q707, Collector	1.2 V rms
PL Tone Output (BLK-GRN WIRE)	0.60 V rms

NOTES:
1. Readings may be taken without keying transmitter.
2. All readings taken with Motorola AC Voltmeter are referenced to chassis.

EPS-4792-O

TABLE II.

"PRIVATE-LINE" DECODER MEASUREMENTS

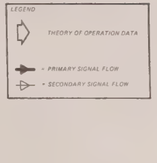
METERING POINT	TYPICAL READING*
Decoder Board Input (GRAY-GRN lead)	60 mV rms
PL Amplifier, Base (Q751)	16 mV rms
PL Amplifier, Collector (Q751)	220 mV rms
Amplifier/Clipper, Base (Q752)	2.8 V rms
Amplifier/Clipper, Collector (Q752)	2.8 V rms
"Vibraspondor" Driver, Base (Q753)	540 mV rms
"Vibraspondor" Driver, Emitter (Q753)	500 mV rms
Amplifier, Base (Q754)	100 mV rms
Amplifier, Collector (Q754)	2.0 V rms
Detector, Base (Q755)	1.8 V rms
Detector, Collector (Q755)	2.7 V dc
Output Switch, Base (Q756)	11.4 V dc
Output Switch, Collector (Q756)	11.9 V dc
Noise Switch, Base (Q757)	0.7 V dc

*Readings taken with 1000-mV input of signal and 0.5-kHz PL tone deviation.

EPS-4793-A

REVISIONS PEPS-4949-F

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN4448A-1	C751	0.0047-.05 mf Tol. (50 wv)	A4
	R754	100Ω +10% Quick-Tak 1/4W	B5
TLN4448A-2	C751	0.0047-.05 mf Tol. (50 wv)	A5
	R704	19.6K-20K-20.4K Ohms 1/4 W 1% FROM 8-124A80 820 Ohms TO 8-124A72 9.1k Ohms	



TONE "PRIVATE-LINE" ENCODER-DECODER

68P81025E72-B
6/9/76-PO

1. UNIQUE THEORY

a. Encoder

When the transmitter is keyed, Q701 and Q703 are immediately turned on. Q703 supplies current to keying switch driver Q1007 on the dc switching and transmitter protection board. When the push-to-talk button is released, Q701 and Q702 are turned off but Q702 turns on again after capacitor C701 is discharged through R704. It should be noted that during the discharge time (approximately 150 milliseconds) Q702 is off and Q703 is on. Finally as Q702 is turned on, Q703 is turned off. This action removes the voltage from Q1007, which turns off the keying switch transistor, turning off the transmitter.

b. Decoder

The detected output of Q755 is applied to the output switching transistor (Q756) which provides a dc voltage for biasing the switching transistor (Q347). The noise (carrier) squelch detector (Q346) also provides dc voltage for biasing Q347. If both of the voltages exceed a certain level (approximately 10 V), the audio switching transistor (Q347) base-emitter junction will be back-biased and the first audio amplifier (Q340) will conduct.

The PL low-pass filter is paralleled by a high-pass circuit to prevent erratic operation of the "Vibrasponder" reed because of noise. The high-pass filter passes some higher frequency noise components which tend to drive the amplifier/clipper into limiting. The resulting saturation of Q751 effectively reduces the PL squelch sensitivity.

When the proper tone signal is received and the audio pre-driver stage is turned on, the high-pass path is shorted to ground through the noise switch (Q757). With the high frequency noise removed, the PL squelch sensitivity is at maximum to insure an unsquelched receive condition until the end of the transmission.

2. TROUBLESHOOTING DATA

a. "Private-Line" Encoder

If transmitter deviation with PL tone applied is improper, check the tone oscillator and tone amplifier circuits. The typical ac signal levels, given in TABLE I, were measured with a Motorola Transistorized AC Voltmeter. Signal levels may vary widely depending upon the frequency of the "Vibrasender" Resonant Reed.

The phase of the signal at the tone generator output should reverse when the transmitter is keyed and revert to the original condition immediately when unkeyed. The "Vibrasender" Resonant Reed can be checked quickly by plugging it into a Motorola SLN6221A "Private-Line" Tone Generator. If a tone output is generated, the reed is good. Make dc voltage checks and resistance checks to isolate the defective part.

If "squelch tail" noise bursts are heard in listening receivers, check voltages in the "reverse burst" switch circuit of the transmitting station. DC voltages given on the schematic are for the transmitter keyed condition. Figure 1 shows the important transient waveforms which should be seen in the "reverse burst" circuitry when the transmitter is unkeyed.

b. "Private-Line" Decoder

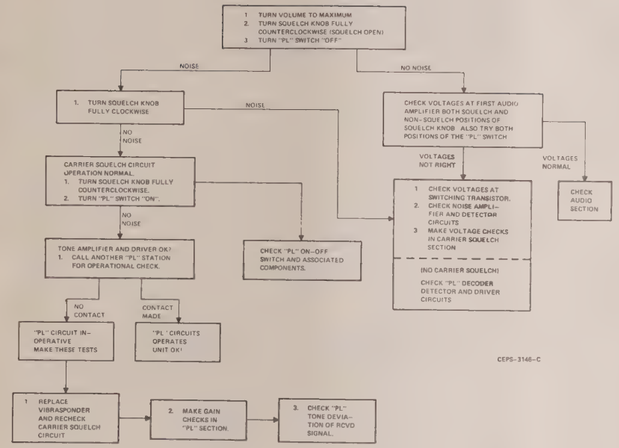
A general check of the "Private-Line" circuit performance may be conducted as follows:

(1) Receiver PL squelch sensitivity should be 0.25 uV (0.15 uV with preamplifier) or less. Place the radio in the PL mode. Turn the SQUELCH control fully counterclockwise. Modulate the signal generator with the "Private-Line" tone frequency stamped on the "Vibrasponder" Resonant Reed of the radio set. (This should be done with the Motorola SLN6221A "PL" Tone Generator to insure that the signal is modulated with the exact PL frequency.) Adjust the modulating tone for 0.5 kHz deviation. Set the signal generator output to zero and increase until noise is heard in the speaker. No more than 0.25 uV should be required.

If "Private-Line" squelch sensitivity in the receiver is low or the circuit is inoperative, use TABLE II and the troubleshooting chart to localize the trouble area.

(2) There should be no "squelch tail" (noise burst) at the end of a transmission from other stations in the communications system. A "squelch tail" is indicative of improper operation of the transmitter PL delay circuitry. Refer to the section on transmitter servicing.

EPS-17356-O


1. TURN VOLUME TO MAXIMUM
2. TURN SQUELCH KNOB FULLY COUNTERCLOCKWISE (SQUELCH OPEN)
3. TURN "PL" SWITCH "OFF"
NOISE
NO NOISE
1. TURN SQUELCH KNOB FULLY CLOCKWISE
NOISE
CHECK VOLTAGES AT FIRST AUDIO AMPLIFIER BOTH SQUELCH AND NON-SQUELCH POSITIONS OF SQUELCH KNOB. ALSO TRY BOTH POSITIONS OF THE "PL" SWITCH
NO NOISE
CARRIER SQUELCH CIRCUIT OPERATION NORMAL
1. TURN SQUELCH KNOB FULLY COUNTERCLOCKWISE.
2. TURN "PL" SWITCH "ON".
VOLTAGES NOT RIGHT
VOLTAGES NORMAL
CHECK AUDIO SECTION
NO NOISE
1. CHECK VOLTAGES AT SWITCHING TRANSISTOR.
2. CHECK NOISE AMPLIFIER AND DETECTOR CIRCUITS
3. MAKE VOLTAGE CHECKS IN CARRIER SQUELCH SECTION
TONE AMPLIFIER AND DRIVER OK?
1. CALL ANOTHER "PL" STATION FOR OPERATIONAL CHECK.
CHECK "PL" ON-OFF SWITCH AND ASSOCIATED COMPONENTS.
(NO CARRIER SQUELCH)
CHECK "PL" DECODER DETECTOR AND DRIVER CIRCUITS
NO CONTACT
CONTACT MADE
"PL" CIRCUIT IN-OPERATIVE. MAKE THESE TESTS
"PL" CIRCUITS OPERATES. UNIT OK!
1. REPLACE VIBRASPONDER AND RECHECK CARRIER SQUELCH CIRCUIT
2. MAKE GAIN CHECKS IN "PL" SECTION
3. CHECK "PL" TONE DEVIATION OF RCVD SIGNAL.

CEPS-3146-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

IMPORTANT

USE ONLY THE FOLLOWING MOTOROLA PART NUMBERS WHEN ORDERING REPLACEMENT PARTS

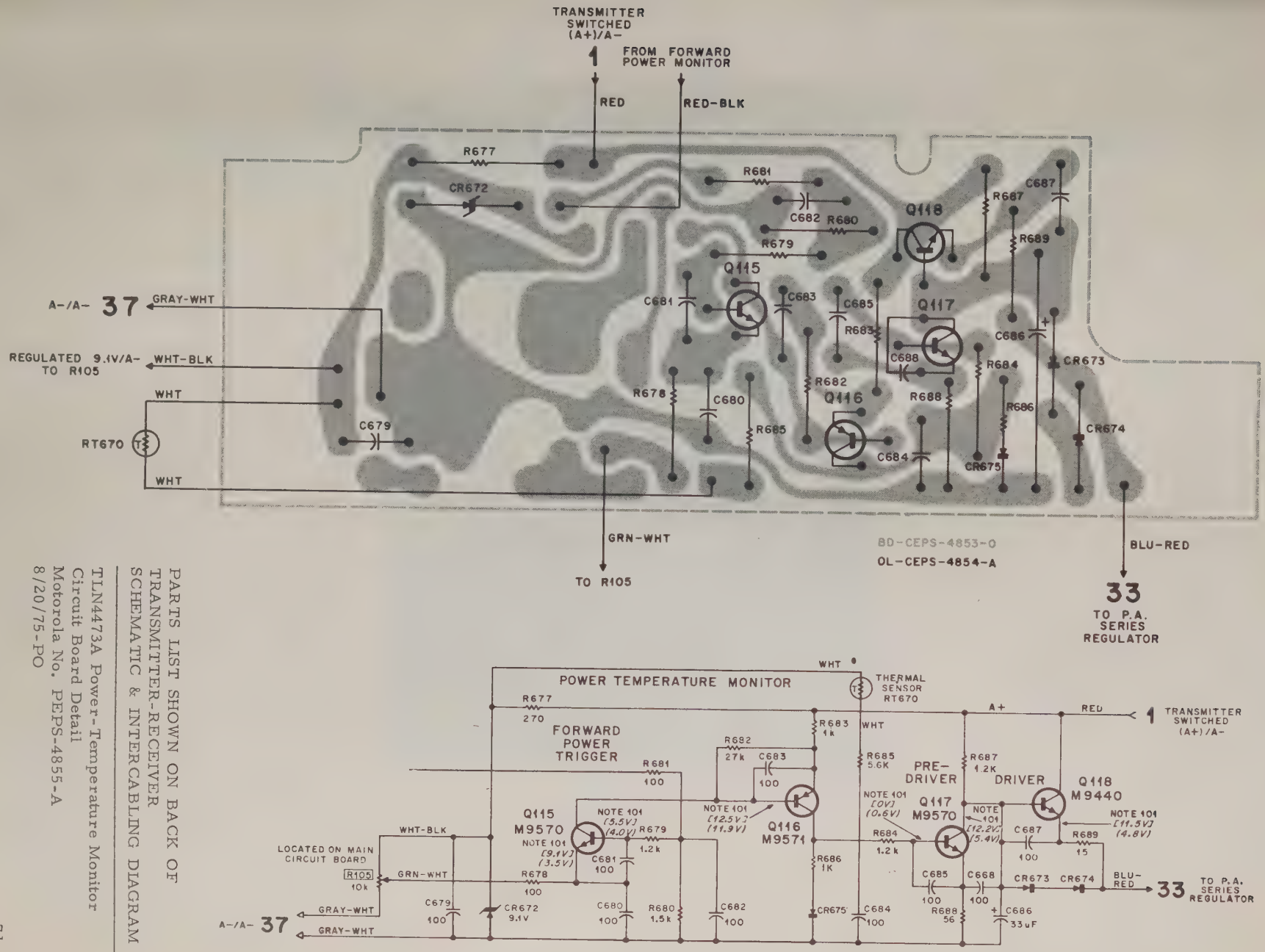
TLN6448A "Private-Line" Encoder & Decoder PL-1227-E

		CAPACITOR, fixed: pF ±10%; unless otherwise stated
C701	23D84762H16	22 uF; 20 V
C702	21-82187B21	820, ±5%; 200 V
C703	23-83214C02	15 ±20%; 25 V
C704	8-82905G06	0.47 uF
C705	23-83214C15	4.7 uF ±20%; 25 V
C706	8-83293B18	0.15 uF
C707	8-82905G06	0.47 uF
C708	8-82905G26	.0047 uF, ±5%; 100 V
C709, 710	8-82905G04	.068 uF
C711	8-82905G06	0.47 uF
C712	8-82905G03	.047 uF
C751	21-865922	390; 500 V
C752	8-82905G11	0.22 uF
C753	8-82905G08	.033 uF
C754	8-82905G07	0.1 uF
C755	21-82187B18	.0015 uF, ±5%; 100 V
C756	8-82905C04	.068 uF
C757	8-82905G01	.01 uF
C758, 759	8-82905G04	.068 uF
C760	8-82905G02	.022 uF
C761	8-82905G04	.068 uF
C762	23-83214C02	15 uF ±20%; 25 V
C763	8-82905C05	0.15 uF
C764	8-82905C08	.033 uF
C765	8-82905C09	0.12 uF
C766	8-82905G04	.068 uF
C767	23-82601A25	100 uF +150-10%; 20 V
C769, 770	21-844163	1500; 250 V
		SEMICONDUCTOR DEVICE, diode
CR701 thru 704	48-82466H01	silicon
CR705 thru 711, 751 thru 754	48-83654H01	silicon
		"VIBRASENDER" RESONANT REED
E701	TLN6824A	"plug-in" unit
		VIBRASPONDER" RESONANT REED
[illegible]	TLN8381A	"plug-in" unit
		COIL, RF
L751	24-84003A01	AF choke; 6 H
L752	24-84004A01	AF choke; 6 H; shielded
		TRANSISTOR
[illegible]	48-869329	N-P-N; type M9329
[illegible]	48-869571	P-N-P; type M9571
[illegible]	48-869328	P-N-P; type M9328
[illegible]	48-869327	P-N-P; type M9327
[illegible]	48-869197	N-P-N; type M9197
[illegible]	48-869570	N-P-N; type M9570
[illegible]	48-869571	P-N-P; type M9571
[illegible]	48-869570	N-P-N; type M9570
[illegible]	48-869570	N-P-N; type M9570
[illegible]	48-869570	N-P-N; type M9570
[illegible]	48-869570	N-P-N; type M9570
[illegible]	48-869570	N-P-N; type M9570

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Q756	48-869571	P-N-P; type M9571
Q757	48-869570	N-P-N; type M9570
		RESISTOR, fixed: ±5%; 1/4 W; unless otherwise stated
R701	6-129818	820
R702	6-124A39	390
R703	6-129862	150 ±10%
R704	6B124A72	[illegible]
R705	6-129887	[illegible]
R707	6-129681	[illegible]
R708	6-129984	[illegible]
R709	6-129805	[illegible]
R710	6-129752	270 ±10%
R711	6-129820	1.8k ±10%
R712	6-118227	15; 1 W
R713	6-129777	39k
R714	6-128683	150k
R715	6-129886	27k
R716	6-129669	4.7k
R717	6-129984	680
[illegible]	6-129887	12k
[illegible]	6-129149	470k
[illegible]	6-131857	680k
[illegible]	6-129707	2.7k
[illegible]	6-124A37	330
[illegible]	6-124A31	180
[illegible]	6-129982	5.6k
[illegible]	6-129299	68k ±10%
[illegible]	6-129299	68k ±10%
[illegible]	6-128686	8.2k ±10%
[illegible]	6-128683	150k
R731	6-129526	33k
R832	6-129987	120k ±10%
R733	6-124B12	390k
R735	6-129149	470k
R736	6-129188	820k
[illegible]	6-129013	1 meg ±10%
[illegible]	6-129526	33k
[illegible]	6-128689	2.2k ±10%
[illegible]	6-124A74	11k
[illegible]	6-16373	150 ±10%
R751	6-128689	2.2k ±10%
R752	6-128687	6.8k ±10%
R753	6-129225	10k ±10%
R754	6-129225	10k ±10%
[illegible]	6-129225	10k ±10%
[illegible]	6-131527	47k
R757	6-129709	470
R758	6-129667	22k
R759	6-131527	47k
[illegible]	6-129709	470
[illegible]	6-129667	22k
[illegible]	6-129225	10k ±10%
[illegible]	6-129431	180
[illegible]	6-124A97	100k
[illegible]	6-129669	4.7k
R769	6-129779	560
R770	6-129753	100 ±10%
R771	6-129669	4.7k
[illegible]	6-124A97	100k
[illegible]	6-131527	47k
[illegible]	6-129804	2.2k
[illegible]	6-124A13	33
[illegible]	6-129225	10k ±10%
[illegible]	6-128689	2.2k ±10%
[illegible]	6-129669	4.7k
[illegible]	6-129147	220k ±10%
[illegible]	6-129669	4.7k
NON-REFERENCED ITEM		
	14-83485C01	SOCKET, "Vibrasponder" resonant reed 4-contact

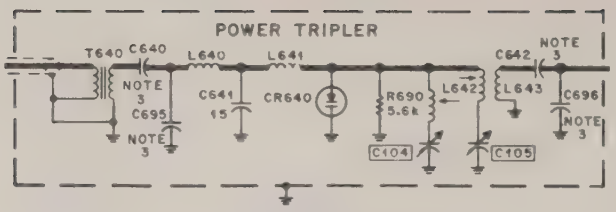
PARTS LIST SHOWN ON BACK OF
TRANSMITTER-RECEIVER
SCHEMATIC & INTERCABLING DIA

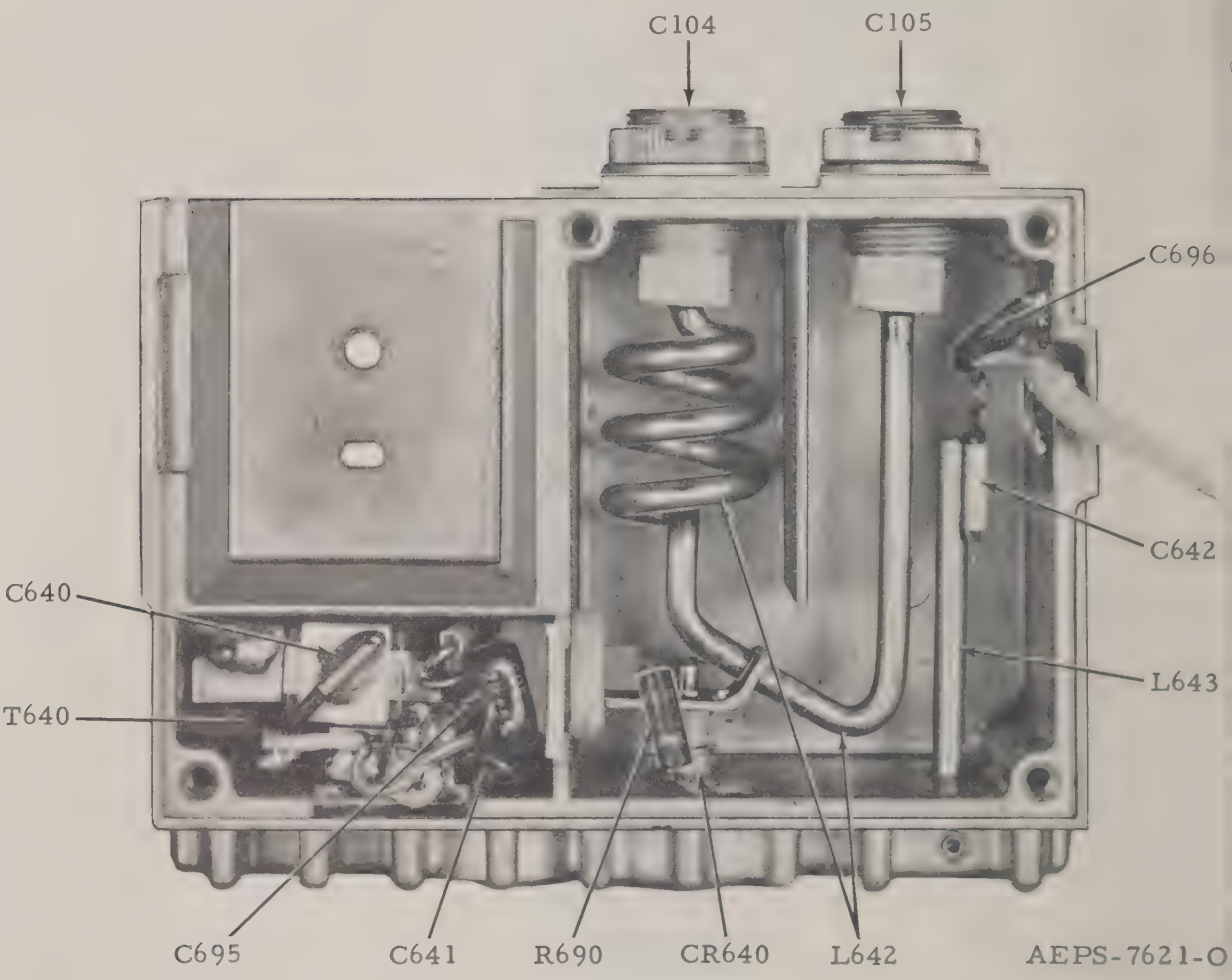
Model TLE1550A Series Power Ampli
Circuit Board Detail
Motorola No. PEPS-9181-F
6/9/76-PO



PARTS LIST SHOWN ON BACK OF
TRANSMITTER-RECEIVER
SCHEMATIC & INTERCABLING DIAGRAM

TLN4473A Power-Temperature Monitor
Circuit Board Detail
Motorola No. PEPS-4855-A
8/20/75-PO





PARTS LIST SHOWN ON BACK OF
TRANSMITTER-RECEIVER
SCHEMATIC & INTERCABLING DIAGRAM

TLE6570A Series Power Tripler
Parts Location Detail
Motorola No. PEPS-4866-B
6/9/76-PO

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

IMPORTANT

USE ONLY THE FOLLOWING MOTOROLA PART NUMBERS WHEN ORDERING REPLACEMENT PARTS

TLN1097A Time-Out Timer — PL-1118-O

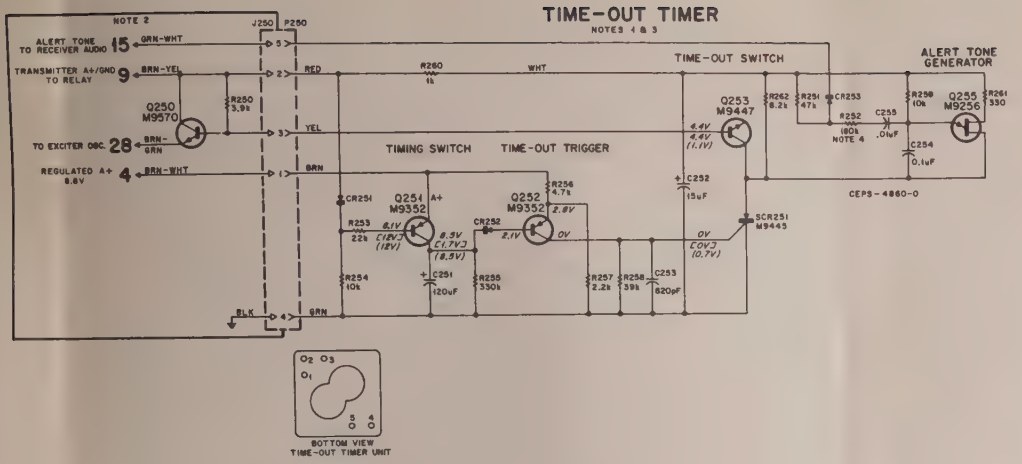
		CAPACITOR, fixed: uF ±10%, unl stated
C251	23D83185D01	120 15 V
C252	23D83214C07	15 ±20%, 25 V
C253	21C82187B17	820 pF 500 V
C254	8D83293B01	0.1, 50 V
C255	21D82428B59	01 ±20%, 200 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR251	48C82392B03	silicon
CR252	48C82392B09	silicon
CR253	48C82392B03	silicon
		TRANSISTOR: (SEE NOTE)
Q251	48R869352	P-N-P type M9352
Q252	48R869352	P-N-P: type M9352
Q253	48R869447	N-P-N type M9447
Q255	48R869256	unijunction, type M9256
		RESISTOR, fixed: ±10%; 1/4 W, unl. stated
R251	6S128902	47K
R252	6S129229	180K
R253	6S128685	22K
R254	6S129225	10K
R255	6S129473	330K ±5%
R256	6S129669	4.7K ±5%
R257	6K129804	2 2K ±5%
R258	6K128903	39K
R259	6S129226	10K
R260	6S127802	1K
R261	6S129775	330
R262	6S128686	8 2K
		RECTIFIER, control:
SCR251	58R869445	type M9445
NON-REFERENCED ITEMS		
	1V807b3A66 TLN8403A	SOCKET ASSY timer board CIRCUIT BOARD ASSEMBLY, does not include CR253, R252

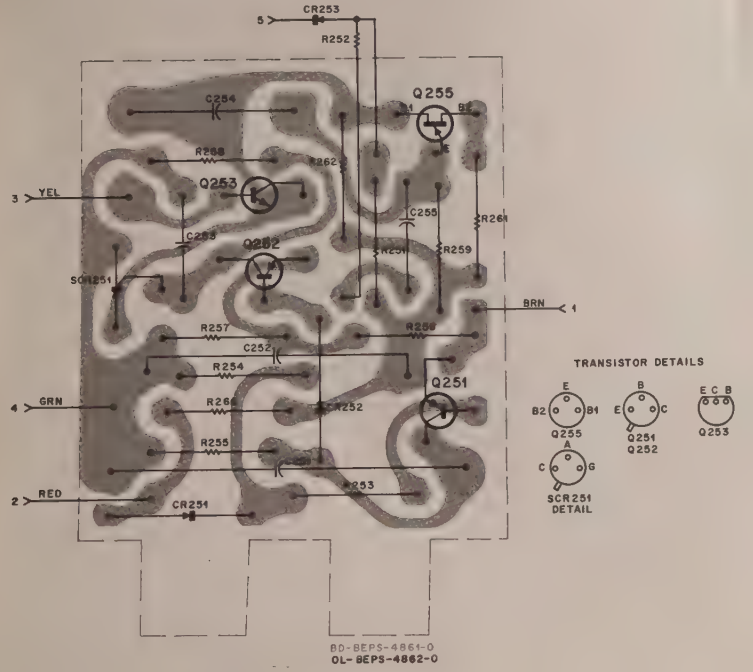
TLN4323A Installation Kit — PL-1021-O

Q250	48R869570	TRANSISTOR: (SEE NOTE) N-P-N, type M9570
R250	6S129232	RESISTOR, fixed: 3.9k ±10%, 1/4 W
NON-REFERENCED ITEMS		
	1V80708B80	CIRCUIT BOARD ASSY.
	41A82114E01	SPRING, crystal hold-down
	3S134184	SCREW, tapping: No. 4-40 x 5/16

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.





NOTES:

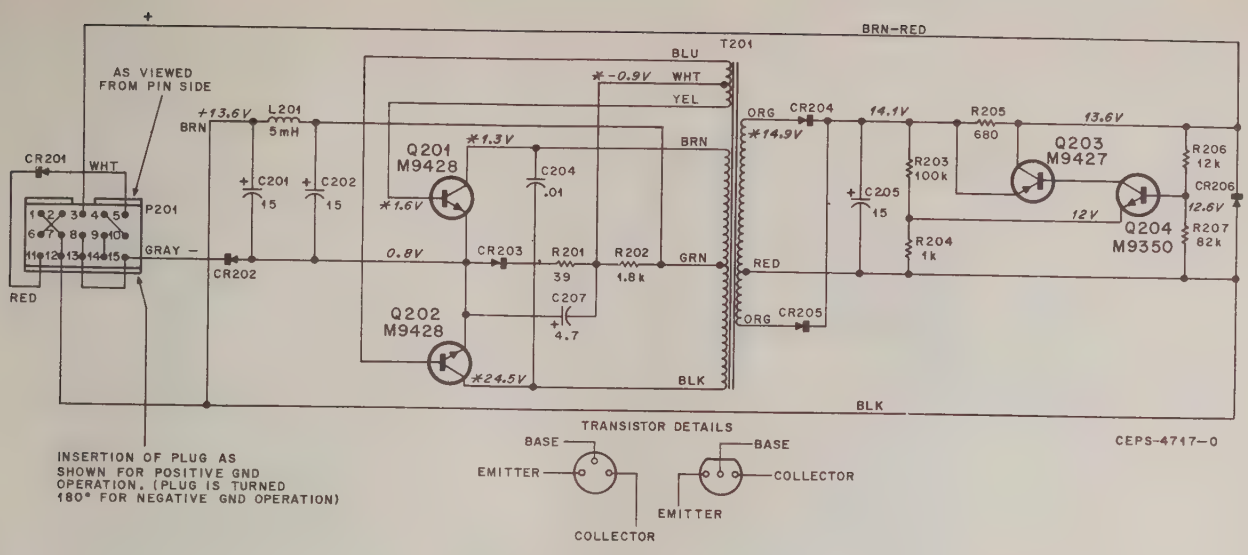
1. VOLTAGE READING CONDITIONS, [ ] = TRANSMITTER KEYED READING, ( ) = TIMED-OUT READING
2. TIME-OUT TIMER AND CONNECTIONS ARE OPTIONAL. Q250, R252, AND J250 ARE NOT SUPPLIED UNLESS UNIT IS FACTORY EQUIPPED WITH TIME-OUT TIMER.
3. A COMPONENT (CR104) IS OMITTED FROM TRANSMITTER IN UNITS EQUIPPED WITH TIME-OUT TIMER.
4. DECREASE VALUE OF R252 TO INCREASE VOLUME OF OUTPUT ALERT TONE.

R252 VALUE	SPEAKER OUTPUT VARIATIONS IN dB
47k	+10.1
56k	+ 8.4
68k	+ 7.2
120k	+ 2.8
180k	Reference (100 mV)
270k	- 2.8
330k	- 6
470k	- 9.8
680k	-13.8

TLN1097A T-O-T		
TLN8403A T-O-T BOARD	TLN8404 COMPONENTS KIT	TLN4323A T-O-T ADAPTER KIT

EPS-4863-O

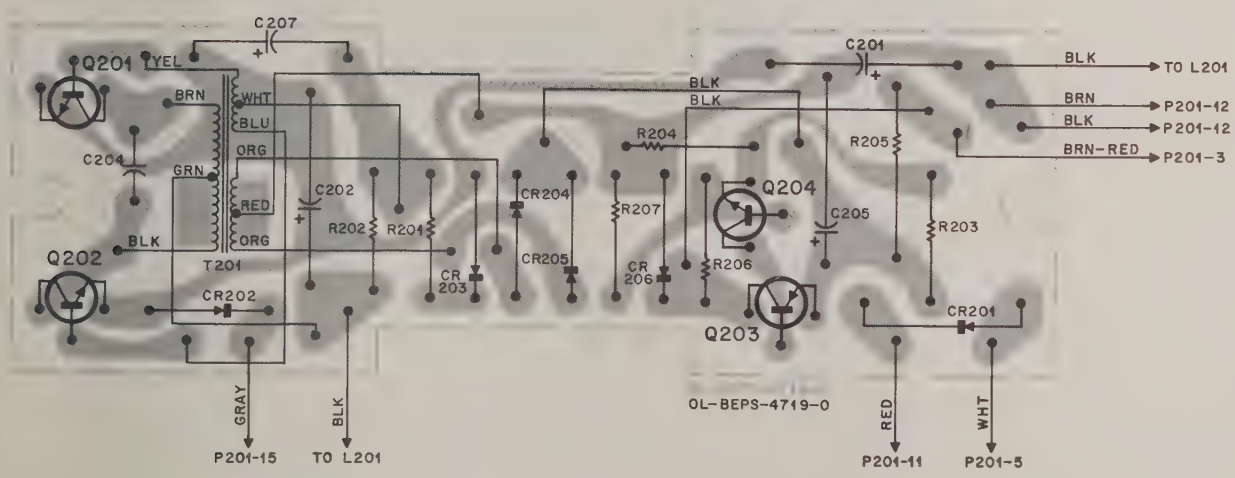
Time-Out Timer & Adapter Kit
Schematic Diagram & Circuit Board Detail
Motorola No. 63P81011E48-O
8/20/75-PO



NOTES:

1. ALL RESISTANCES ARE IN OHMS, ±10%. ALL CAPACITANCES ARE IN MICROFARADS.
2. CHOKE L201 IS NOT MOUNTED ON THE PRINTED CIRCUIT BOARD.
3. ALL PRIMARY CIRCUIT VOLTAGES ARE MEASURED WITH RESPECT TO PIN 15.
4. ALL SECONDARY CIRCUIT VOLTAGES ARE MEASURED WITH RESPECT TO PIN 12.
5. VOLTAGES MARKED WITH AN ASTERISK (*) ARE MEASURED WITH AN OSCILLOSCOPE.
6. SEE PARTS LIST FOR RESISTOR WATTAGE RATINGS.

EPD-14784-A



PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Model TLN8482A Ground Reversing Kit
Schematic Diagram and Circuit Board Detail
Motorola No. 63P81011E49-O
8/20/75-PO

PARTS LIST

TLN8482A Ground Reversing Kit EPD-14846-D

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF
C201, 202, 205	23K865136	15 ±20%; 25 V
C204	21D82428B40	.01 +60-40%; 250 V
C207	23K865137	4.7 ±20%; 25 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR201	48C82525G07	silicon
CR202	48C82466H01	silicon
CR204, 205	48C82466H12	silicon
CR203, 206	48C82392B03	silicon
		COIL, audio: choke
L201	25B82142H01	5 mH
		CONNECTOR, plug: ass'y;
P201	1V80735A23	male; 15 contact; includes 14C82141H01 INSULATOR, 29C82335A01 TERMINAL
		TRANSISTOR: (SEE NOTE)
Q201, 202	48R869428	N-P-N; type M9428
Q203	48R869427	P-N-P; type M9427
Q204	48R869350	N-P-N; type M9350
		RESISTOR, fixed: ±10%; 1/4 W; unl. stated
R201	6S131652	39
R202	6S129269	1.8K
R203	6S129226	100K
R204	6K127802	1K
R205	6S6040	680; 1/2 W
R206	6S129230	12K
R207	6S129145	82K
		TRANSFORMER:
T201	25D83633D01	pri. No. 1: BLU, YEL w/center tap @ WHT; total coil res. .087 ohms pri. No. 2: BRN, BLK w/center tap @ GRN; total coil res. 0.16 ohms sec: ORG, ORG w/center tap @ RED; total coil res. 0.339

NOTE:
Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

TABLE III.

TRANSMITTER AUDIO AND RF VOLTAGE READINGS

METERING POINT	TYPICAL VOLTAGE READINGS (rms)		
	Emitter	Base	Collector
...Amplifier Q35, Note 1	46 mV	40 mV	140 mV
...Q35, Note 1	---	2.1 mV	1.3 V
...Amplifier Q36, Note 1	1.1 V	---	---
...Q124, Q125, Q126, Q127)	---	-	1.7 V
...Q128)	---	6.8 V	4.6 V
...Amplifier Q126)	---	3.6 V	4.1 V
...Amplifier Q108)	---	1.4 V	4.6 V
...Q114)	---	2.4 V	5.5 V
...)	---	5.0 V	12.0 V
...Amplifiers (Q117, Q123)	---	8.0 V	14.0 V

(1) Audio readings are taken with 0.1 V rms of 1000-Hz tone applied at the microphone connector.

All voltages measured with respect to chassis ground.

Supply voltage = 13.6 V dc.

TABLE IV.

TYPICAL RECEIVER GAIN DISTRIBUTION

METERING POINT	RF VOLTAGE AT ANTENNA CONNECTOR	NOMINAL RF VOLTAGE AT METERING POINT
...Gate (Q1)	25 mV	0.50 V
...Base (Q1)	25 mV	2.1 V
...Emitter (Q1)	25 mV	0.30 V
...Base (Q2)	25 mV	0.12 V
...Collector (Q2)	25 mV	0.24 V

(1) All voltages referenced to chassis ground.

(2) Supply voltage = 13.8 V dc.

(3) All voltages measured with Motorola Model S1052B DC Multimeter using the SLN6055A RF Probe.

(4) Multiply all voltages by 2 when preamplifier is used.

EPS-4745-O

TABLE V.

TYPICAL RECEIVER GAIN DISTRIBUTION

METERING POINT	RF VOLTAGE AT ANTENNA CONNECTOR	NOMINAL RF VOLTAGE AT METERING POINT
1st 455 kHz IF Amp Base (Q301)	2 mV	0.11 V
1st 455 kHz IF Amp Coll (Q301)	1 mV	2.5 V

NOTES:
1. All voltages referenced to chassis ground
2. Supply Voltage = 13.8 V dc.
3. All voltages measured with Motorola Solid-State dc multimeter with rf probe

EPS-4748-O

TABLE VI.

LIMITER NOISE VOLTAGES WITH NO CARRIER SIGNAL

METERING POINT	NOMINAL VOLTAGES (rms)
Base of 1st 455 kHz Limiter (Q304)	1.1 V
Base of 2nd 455 kHz Limiter (Q305)	1.16 V
Base of 3rd 455 kHz Limiter (Q306)	1.2 V
Collector of 3rd 455 kHz Limiter (Q306)	4.8 V

NOTES:
1. All voltages measured with Motorola Model S1052B DC Multimeter using the SLN6055A RF Probe.
2. All voltages referenced to chassis ground.

EPS-4797-O

TABLE VII.

TYPICAL AUDIO NOISE VOLTAGES WITH NO CARRIER SIGNAL

CIRCUIT METERED	TYPICAL READING
Discriminator Output (collector of Q108)	1.5 V rms
Emitter Follower Output (Emitter of Q109)	0.53 V rms
Base of 1st Audio Amplifier (Q340)	5 mV rms
Collector of 1st Audio Amplifier (Q340)	0.25 V rms
Base of Audio Driver (Q343)	80 mV
Base of Audio Driver (Q342)	40 mV
Collectors of Audio Drivers (Q341, Q342)	2.9 V rms
Bases of Audio Finals (Q343, Q344)	0.40 V rms
Collectors of Audio Finals (Q343, Q344)	6.6 V rms
Audio output into 3.2 Speaker	3.2 V rms

NOTES:
1. All readings referenced to chassis.
2. All voltages measured with Motorola Model S1053C AC Voltmeter.
3. VOLUME control at maximum fully clockwise; SQUELCH control fully counterclockwise; PL switch OFF.
4. DC Supply Voltage = 13.8 V dc.

EPS-4798-O

TABLE VIII.

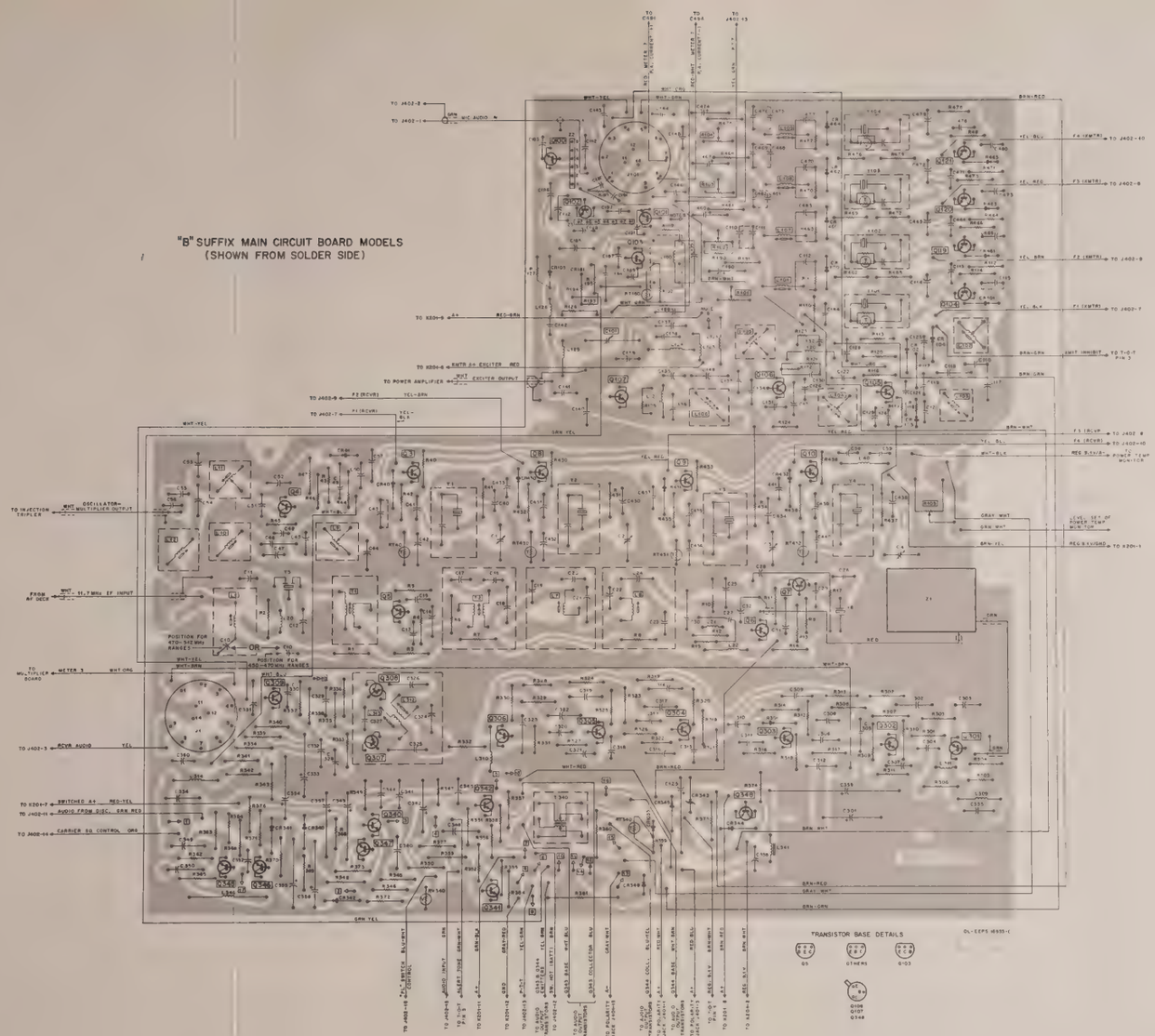
CARRIER SQUELCH NOISE VOLTAGE MEASUREMENTS

CIRCUIT METERED	TYPICAL READING
Squelch Limiter, Base (Q345)	0.32 V rms
Squelch Limiter, Collector (Q345)	3.5 V rms
Squelch Detector, Base (Q346)	0.40 V rms
Squelch Detector, Emitter (Q346)	0.20 V rms

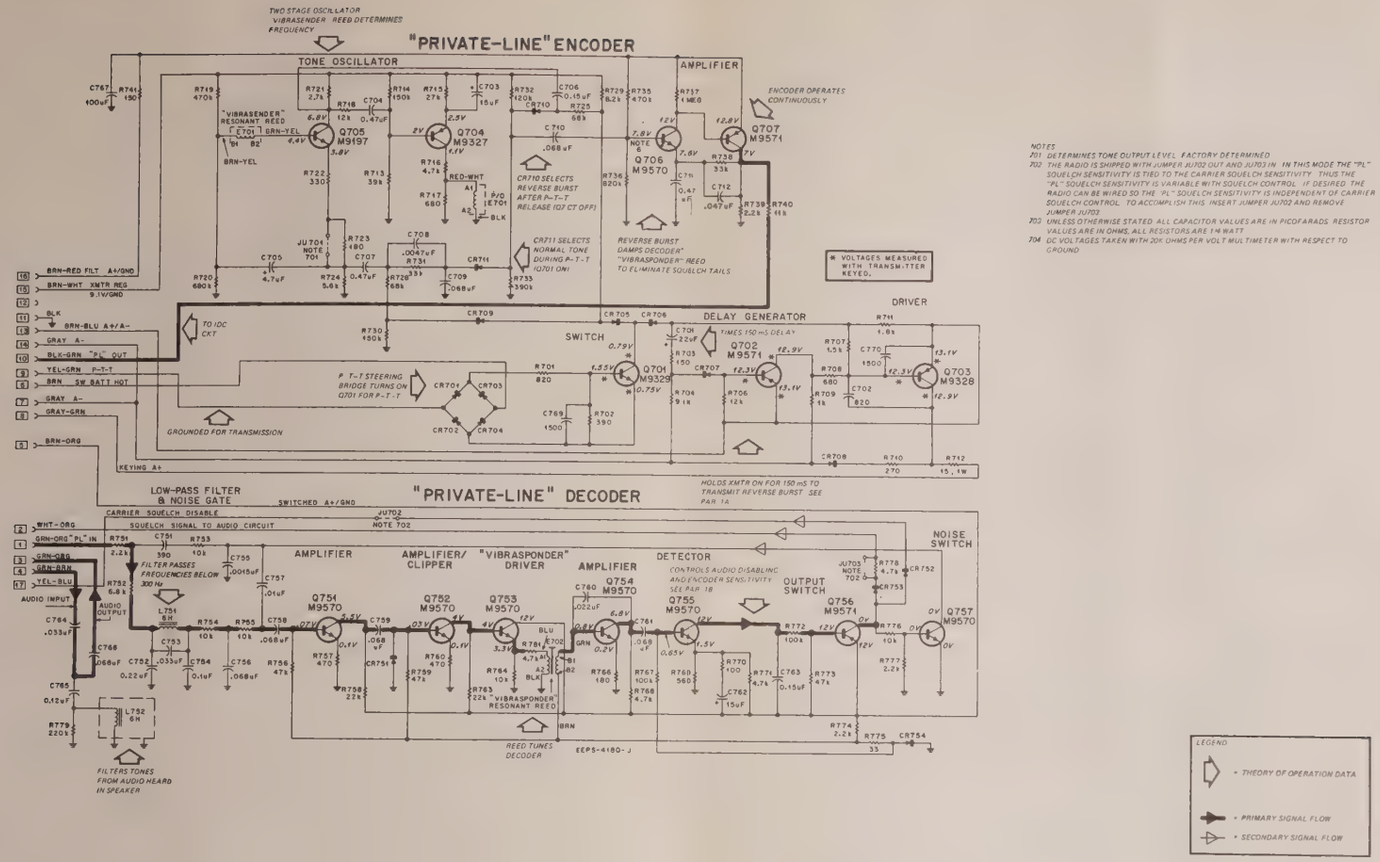
NOTES:
1. All voltages measured with Motorola AC Voltmeter and are referenced to chassis.
2. SQUELCH control at maximum, no signal input.

EPS-4799-O

"B" SUFFIX MAIN CIRCUIT BOARD MODELS
(SHOWN FROM SOLDER SIDE)



B-Suffix Main Board Models
Circuit Board Detail
Motorola No. PEPS-16936-B
6/9/76-PO



NOTES

701 DETERMINES TONE OUTPUT LEVEL. FACTORY DETERMINED.

702 THE RADIO IS SHIPPED WITH JUMPER JU702 OUT AND JU703 IN. IN THIS MODE THE "PL" SQUELCH SENSITIVITY IS TIED TO THE CARRIER SQUELCH SENSITIVITY. THUS THE "PL" SQUELCH SENSITIVITY IS VARIABLE WITH SQUELCH CONTROL. IF DESIRED, THE RADIO CAN BE WIRED SO THE "PL" SQUELCH SENSITIVITY IS INDEPENDENT OF CARRIER SQUELCH CONTROL. TO ACCOMPLISH THIS: INSERT JUMPER JU702 AND REMOVE JUMPER JU703.

703 UNLESS OTHERWISE STATED: ALL CAPACITOR VALUES ARE IN PICOFARADS. RESISTOR VALUES ARE IN OHMS, ALL RESISTORS ARE 1/4 WATT.

704 DC VOLTAGES TAKEN WITH 20K OHMS PER VOLT MULTIMETER WITH RESPECT TO GROUND.

LEGEND
- THEORY OF OPERATION DATA
- PRIMARY SIGNAL FLOW
- SECONDARY SIGNAL FLOW

PARTS LIST SHOWN ON BACK OF TRANSMITTER-RECEIVER SCHEMATIC & INTERCABLING DIAGRAM

"Private-Line" Decoder
Schematic Diagram
Motorola No. 63P81011E31-F
(Sheet 1 of 3)
6/9/76-PO

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION	REFER TO CIRCUIT BOARD
-A-,-A1A2A3 -A4,-A5A6	C104 105	FROM FOLLOWING PARTS: 1.8pF 50V COG TUNING 'N' SW'R 4805-050-C0015 LOCK-WASHER 2331-734-C31 LOCKNUT 4343-522-001 SCREW		PERS-4859 PERS-4861
	C193	REMOVED WAS 0.01MFD 100V MYLAR .10% 50		PERS-4859
	C195	1.8pF 50V COG TUNING		PERS-4861
	C196	1.8pF 50V COG TUNING		PERS-4861
	C197	1.8pF 50V COG TUNING		PERS-4861
	C198	1.8pF 50V COG TUNING		PERS-4861
	C199	1.8pF 50V COG TUNING		PERS-4861
	C200	1.8pF 50V COG TUNING		PERS-4861
	C201	1.8pF 50V COG TUNING		PERS-4861
	C202	1.8pF 50V COG TUNING		PERS-4861
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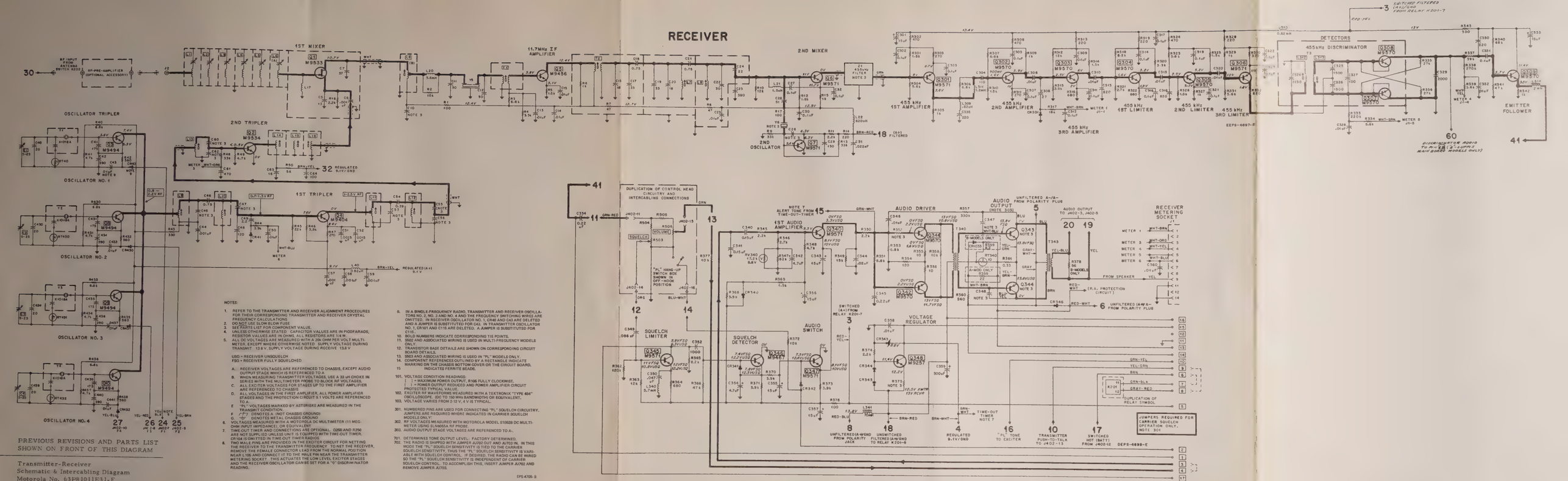
	C298	1.8pF 50V COG TUNING		PERS-4861
	C299	1.8pF 50V COG TUNING		PERS-4861
	C300	1.8pF 50V COG TUNING		PERS-4861
	C301	1.8pF 50V COG TUNING		PERS-4861
	C302	1.8pF 50V COG TUNING		PERS-4861
	C303	1.8pF 50V COG TUNING		PERS-4861
	C304	1.8pF 50V COG TUNING		PERS-4861
	C305	1.8pF 50V COG TUNING		PERS-4861
	C306	1.8pF 50V COG TUNING		PERS-4861
	C307	1.8pF 50V COG TUNING		PERS-4861
	C308	1.8pF 50V COG TUNING		PERS-4861
	C309	1.8pF 50V COG TUNING		PERS-4861
	C310	1.8pF 50V COG TUNING		PERS-4861
	C311	1.8pF 50V COG TUNING		PERS-4861
	C312	1.8pF 50V COG TUNING		PERS-4861
	C313	1.8pF 50V COG TUNING		PERS-4861
	C314	1.8pF 50V COG TUNING		PERS-4861
	C315	1.8pF 50V COG TUNING		PERS-4861
	C316, 317	1.8pF 50V COG TUNING		PERS-4861
	C318	1.8pF 50V COG TUNING		PERS-4861
	C319	1.8pF 50V COG TUNING		PERS-4861
	C320	1.8pF 50V COG TUNING		PERS-4861
	C321, 322	1.8pF 50V COG TUNING		PERS-4861
	C323	1.8pF 50V COG TUNING		PERS-4861
	C324	1.8pF 50V COG TUNING		PERS-4861
	C325, 326	1.8pF 50V COG TUNING		PERS-4861
	C327	1.8pF 50V COG TUNING		PERS-4861
	C328	1.8pF 50V COG TUNING		PERS-4861
	C329	1.8pF 50V COG TUNING		PERS-4861
	C330	1.8pF 50V COG TUNING		PERS-4861
	C331	1.8pF 50V COG TUNING		PERS-4861
	C332	1.8pF 50V COG TUNING		PERS-4861
	C333	1.8pF 50V COG TUNING		PERS-4861
	C334	1.8pF 50V COG TUNING		PERS-4861
	C335	1.8pF 50V COG TUNING		PERS-4861
	C340, 341	1.8pF 50V COG TUNING		PERS-4861
	C342	1.8pF 50V COG TUNING		PERS-4861
	C343	1.8pF 50V COG TUNING		PERS-4861
	C344	1.8pF 50V COG TUNING		PERS-4861
	C345	1.8pF 50V COG TUNING		PERS-4861
	C346	1.8pF 50V COG TUNING		PERS-4861
	C347, 348	1.8pF 50V COG TUNING		PERS-4861
	C349	1.8pF 50V COG TUNING		PERS-4861
	C350	1.8pF 50V COG TUNING		PERS-4861
	C352	1.8pF 50V COG TUNING		PERS-4861
	C354	1.8pF 50V COG TUNING		PERS-4861
	C355, 356, 357	1.8pF 50V COG TUNING		PERS-4861
	C358	1.8pF 50V COG TUNING		PERS-4861
	C359	1.8pF 50V COG TUNING		PERS-4861
	C360	1.8pF 50V COG TUNING		PERS-4861
	C430	1.8pF 50V COG TUNING		PERS-4861
	C431	1.8pF 50V COG TUNING		PERS-4861
	C432	1.8pF 50V COG TUNING		PERS-4861
	C434	1.8pF 50V COG TUNING		PERS-4861
	C435	1.8pF 50V COG TUNING		PERS-4861
	C436	1.8pF 50V COG TUNING		PERS-4861
	C437	1.8pF 50V COG TUNING		PERS-4861
	C438	1.8pF 50V COG TUNING		PERS-4861
	C439	1.8pF 50V COG TUNING		PERS-4861
	C440	1.8pF 50V COG TUNING		PERS-4861
	C441	1.8pF 50V COG TUNING		PERS-4861
	C442	1.8pF 50V COG TUNING		PERS-4861
	C443	1.8pF 50V COG TUNING		PERS-4861
	C462	1.8pF 50V COG TUNING		PERS-4861
	C463	1.8pF 50V COG TUNING		PERS-4861
	C464	1.8pF 50V COG TUNING		PERS-4861
	C465	1.8pF 50V COG TUNING		PERS-4861
	C466	1.8pF 50V COG TUNING		PERS-4861
	C467	1.8pF 50V COG TUNING		PERS-4861
	C468	1.8pF 50V COG TUNING		PERS-4861
	C469	1.8pF 50V COG TUNING		PERS-4861
	C470	1.8pF 50V COG TUNING		PERS-4861
	C471	1.8pF 50V COG TUNING		PERS-4861
	C472	1.8pF 50V COG TUNING		PERS-4861
	C473	1.8pF 50V COG TUNING		PERS-4861
	C474	1.8pF 50V COG TUNING		PERS-4861
	C475	1.8pF 50V COG TUNING		PERS-4861
	C476	1.8pF 50V COG TUNING		PERS-4861
	C477	1.8pF 50V COG TUNING		PERS-4861
	C478	1.8pF 50V COG TUNING		PERS-4861
	C479	1.8pF 50V COG TUNING		PERS-4861
	C490	1.8pF 50V COG TUNING		PERS-4861
	C491, 492	1.8pF 50V COG TUNING		PERS-4861
	C493	1.8pF 50V COG TUNING		PERS-4861
	C494, 495, 496, 497	1.8pF 50V COG TUNING		PERS-4861
	C498, 499	1.8pF 50V COG TUNING		PERS-4861
	C600L, C600M	1.8pF 50V COG TUNING		PERS-4861
	C600H	1.8pF 50V COG TUNING		PERS-4861
	C601H	1.8pF 50V COG TUNING		PERS-4861
	C602	1.8pF 50V COG TUNING		PERS-4861
	C603	1.8pF 50V COG TUNING		PERS-4861
	C604	1.8pF 50V COG TUNING		PERS-4861
	C605	1.8pF 50V COG TUNING		PERS-4861
	C606	1.8pF 50V COG TUNING		PERS-4861
	C607H	1.8pF 50V COG TUNING		PERS-4861
	C607M	1.8pF 50V COG TUNING		PERS-4861
	C607H	1.8pF 50V COG TUNING		PERS-4861
	C608L, C608M	1.8pF 50V COG TUNING		PERS-4861
	C608H	1.8pF 50V COG TUNING		PERS-4861
	C609L	1.8pF 50V COG TUNING		PERS-4861
	C609M	1.8pF 50V COG TUNING		PERS-4861
	C609H	1.8pF 50V COG TUNING		PERS-4861
	C610	1.8pF 50V COG TUNING		PERS-4861
	C611	1.8pF 50V COG TUNING		PERS-4861
	C612	1.8pF 50V COG TUNING		PERS-4861
	C613	1.8pF 50V COG TUNING		PERS-4861
	C614L	1.8pF 50V COG TUNING		PERS-4861
	C614M	1.8pF 50V COG TUNING		PERS-4861
	C614H	1.8pF 50V COG TUNING		PERS-4861
	C615	1.8pF 50V COG TUNING		PERS-4861
	C617L, C617M	1.8pF 50V COG TUNING		PERS-4861
	C617H	1.8pF 50V COG TUNING		PERS-4861
	C618L, C618M	1.8pF 50V COG TUNING		PERS-4861
	C618H	1.8pF 50V COG TUNING		PERS-4861
	C620	1.8pF 50V COG TUNING		PERS-4861
	C621	1.8pF 50V COG TUNING		PERS-4861
	C622L, C622M	1.8pF 50V COG TUNING		PERS-4861
	C622H	1.8pF 50V COG TUNING		PERS-4861
	C623	1.8pF 50V COG TUNING		PERS-4861
	C624	1.8pF 50V COG TUNING		PERS-4861
	C625	1.8pF 50V COG TUNING		PERS-4861
	C626L	1.8pF 50V COG TUNING		PERS-4861
	C626M	1.8pF 50V COG TUNING		PERS-4861
	C626H	1.8pF 50V COG TUNING		PERS-4861
	C627	1.8pF 50V COG TUNING		PERS-4861
	C628	1.8pF 50V COG TUNING		PERS-4861
	C634	1.8pF 50V COG TUNING		PERS-4861
	C635L	1.8pF 50V COG TUNING		PERS-4861
	C635M	1.8pF 50V COG TUNING		PERS-4861
	C635H	1.8pF 50V COG TUNING		PERS-4861
	C636L, C636M	1.8pF 50V COG TUNING		PERS-4861
	C636H	1.8pF 50V COG TUNING		PERS-4861
	C637L, C637M	1.8pF 50V COG TUNING		PERS-4861
	C637H	1.8pF 50V COG TUNING		PERS-4861
	C638L, C638M	1.8pF 50V COG TUNING		PERS-4861
	C638H	1.8pF 50V COG TUNING		PERS-4861
	C639L, C639M	1.8pF 50V COG TUNING		PERS-4861
	C639H	1.8pF 50V COG TUNING		PERS-4861
	C640L, C640M	1.8pF 50V COG TUNING		PERS-4861
	C640H	1.8pF 50V COG TUNING		PERS-4861
	C641L, C641M	1.8pF 50V COG TUNING		PERS-4861
	C641H	1.8pF 50V COG TUNING		PERS-4861
	C642L, C642M	1.8pF 50V COG TUNING		PERS-4861
	C642H	1.8pF 50V COG TUNING		PERS-4861
	C643L, C643M	1.8pF 50V COG TUNING		PERS-4861
	C643H	1.8pF 50V COG TUNING		PERS-4861
	C644L, C644M	1.8pF 50V COG TUNING		PERS-4861
	C644H	1.8pF 50V COG TUNING		PERS-4861
	C645L, C645M	1.8pF 50V COG TUNING		PERS-4861
	C645H	1.8pF 50V COG TUNING		PERS-4861
	C646L, C646M	1.8pF 50V COG TUNING		PERS-4861
	C646H	1.8pF 50V COG TUNING		PERS-4861
	C647L, C647M	1.8pF 50V COG TUNING		PERS-4861
	C647H	1.8pF 50V COG TUNING		PERS-4861
	C648L, C648M	1.8pF 50V COG TUNING		PERS-4861
	C648H	1.8pF 50V COG TUNING		PERS-4861
	C649	1.8pF 50V COG TUNING		PERS-4861
	C650L, C650M	1.8pF 50V COG TUNING		PERS-4861
	C650H	1.8pF 50V COG TUNING		PERS-4861
	C651L, C651M	1.8pF 50V COG TUNING		PERS-4861
	C651H	1.8pF 50V COG TUNING		PERS-4861
	C652L, C652M	1.8pF 50V COG TUNING		PERS-4861
	C652H	1.8pF 50V COG TUNING		PERS-4861
	C653L, C653M	1.8pF 50V COG TUNING		PERS-4861
	C653H	1.8pF 50V COG TUNING		PERS-4861
	C654	1.8pF 50V COG TUNING		PERS-4861
	C655L, C655M	1.8pF 50V COG TUNING		PERS-4861
	C655H	1.8pF 50V COG TUNING		PERS-4861
	C656L, C656M	1.8pF 50V COG TUNING		PERS-4861
	C656H	1.8pF 50V COG TUNING		PERS-4861
	C658H	1.8pF 50V COG TUNING		PERS-4861
	C659L, C659M	1.8pF 50V COG TUNING		PERS-4861
	C659H	1.8pF 50V COG TUNING		PERS-4861
	C660	1.8pF 50V COG TUNING		PERS-4861
	C661L, C661M	1.8pF 50V COG TUNING		PERS-4861
	C661H	1.8pF 50V COG TUNING		PERS-4861
	C662L, C662M	1.8pF 50V COG TUNING		PERS-4861
	C662H	1.8pF 50V COG TUNING		PERS-4861
	C663L, C663M	1.8pF 50V COG TUNING		PERS-4861
	C663H	1.8pF 50V COG TUNING		PERS-4861
	C664L, C664M	1.8pF 50V COG TUNING		PERS-4861
	C664H	1.8pF 50V COG TUNING		PERS-4861
	C665L, C665M	1.8pF 50V COG TUNING		PERS-4861
	C665H	1.8pF 50V COG TUNING		PERS-4861
	C666L, C666M	1.8pF 50V COG TUNING		PERS-4861
	C666H	1.8pF 50V COG TUNING		PERS-4861
	C667L, C667M	1.8pF 50V COG TUNING		PERS-4861
	C667H	1.8pF 50V COG TUNING		PERS-4861
	C668L, C668M	1.8pF 50V COG TUNING		PERS-4861
	C668H	1.8pF 50V COG TUNING		PERS-4861
	C669L, C669M	1.8pF 50V COG TUNING		PERS-4861
	C669H	1.8pF 50V COG TUNING		PERS-4861
	C670L, C670M	1.8pF 50V COG TUNING		PERS-4861
	C670H	1.8pF 50V COG TUNING		PERS-4861
	C671L, C671M	1.8pF 50V COG TUNING		PERS-4861
	C671H	1.8pF 50V COG TUNING		PERS-4861
	C672L, C672M	1.8pF 50V COG TUNING		PERS-4861
	C672H	1.8pF 50V COG TUNING		PERS-4861
	C673L, C673M	1.8pF 50V COG TUNING		PERS-4861
	C673H	1.8pF 50V COG TUNING		PERS-4861
	C674, 675	1.8pF 50V COG TUNING		PERS-4861
	C676	1.8pF 50V COG TUNING		PERS-4861
	C677	1.8pF 50V COG TUNING		PERS-4861
	C678 thru 685	1.8pF 50V COG TUNING		PERS-4861
	C686	1.8pF 50V COG TUNING		PERS-4861
	C687	1.8pF 50V COG TUNING		PERS-4861
	C688L, 688M	1.8pF 50V COG TUNING		PERS-4861
	C688H	1.8pF 50V COG TUNING		PERS-4861
	C689	1.8pF 50V COG TUNING		PERS-4861
	C690, 691, 692, 693L	1.8pF 50V COG TUNING		PERS-4861
	C693M	1.8pF 50V COG TUNING		PERS-4861
	C693H	1.8pF 50V COG TUNING		PERS-4861
	C694L	1.8pF 50V COG TUNING		PERS-4861
	C694M	1.8pF 50V COG TUNING		PERS-4861
	C694H	1.8pF 50V COG TUNING		PERS-4861
	C695L	1.8pF 50V COG TUNING		PERS-4861
	C695M	1.8pF 50V COG TUNING		PERS-4861
	C695H	1.8pF 50V COG TUNING		PERS-4861
	C696L, C696M	1.8pF 50V COG TUNING		PERS-4861
	C696H	1.8pF 50V COG TUNING		PERS-4861
	C700	1.8pF 50V COG TUNING		PERS-4861
	C701	1.8pF 50V COG TUNING		PERS-4861
	C704	1.8pF 50V COG TUNING		PERS-4861
	C705	1.8pF 50V COG TUNING		PERS-4861
	C706	1.8pF 50V COG TUNING		PERS-4861
	C707	1.8pF 50V COG TUNING		PERS-4861
	C708	1.8pF 50V COG TUNING		PERS-4861
	C709, 710	1.8pF 50V COG TUNING		PERS-4861
	C711	1.8pF 50V COG TUNING		PERS-4861
	C712	1.8pF 50V COG TUNING		PERS-4861
	C751	1.8pF 50V COG TUNING		PERS-4861
	C752	1.8pF 50V COG TUNING		PERS-4861
	C753	1.8pF 50V COG TUNING		PERS-4861
	C754	1.8pF 50V COG TUNING		PERS-4861
	C755	1.8pF 50V COG TUNING		PERS-4861
	C756	1.8pF 50V COG TUNING		PERS-4861
	C757	1.8pF 50V COG TUNING		PERS-4861
	C758, 759	1.8pF 50V COG TUNING		PERS-4861
	C760	1.8pF 50V COG TUNING		PERS-4861
	C761	1.8pF 50V COG TUNING		PERS-4861
	C762	1.8pF 50V COG TUNING		PERS-4861
	C763	1.8pF 50V COG TUNING		PERS-4861
	C764	1.8pF 50V COG TUNING		PERS-4861
	C765	1.8pF 50V COG TUNING		PERS-4861
	C766	1.8pF 50V COG TUNING		PERS-4861
	C767	1.8pF 50V COG TUNING		PERS-4861
	C769, 770	1.8pF 50V COG TUNING		PERS-4861
	CR40	48-8239ZB03	silicon	
	CR41	48-8239G01	germanium	
	CR100	48-8239H13	silicon; varactor type	
	CR101	48-8239Z B03	silicon	
	CR102, 103	48-8239A01	germanium	
	CR104, 105	48-8239Z B03	silicon	
	CR180		NOT USED	
	CR181	48-8256C 18	silicon; Zener type; 9.1 V	
	CR301	48-8239G01	germanium	
	CR340, 341, 342	48-8239Z B03	silicon	
	CR343	48-8256C43	silicon; Zener type; 9.1 V	
	CR344, 345	48-8239Z B03	silicon	
	CR346	48-8256C01	silicon	
	CR401	48-8252G07	silicon	
	CR430, 431, 432	48-8239Z B03	silicon	
	CR460	48-82190H13	silicon; varactor type	
	CR461	48-8239Z B03	silicon	
	CR462	48-82190H13	silicon; varactor type	
	CR463	48-8239Z B03	silicon	
	CR464	48-82190H13	silicon; varactor type	
	CR465	48-8239Z B03	silicon	
	CR640	1-80732B06	assy., varactor type incl. 43-8413C01 BUSHING, mounting	
	CR670, 671	48-8213G01	germanium	
	CR672	48-8256C18	silicon; Zener type; 9.1 V	
	CR673, 674	48-8239Z B03	silicon	
	CR675		NOT USED	
	CR676	48-8239Z B03	silicon	
	CR677	48-8256C 18	silicon; Zener type; 9.1 V	
	CR678	48-8239Z B03	silicon	
	CR679	48-8256C 18	silicon; Zener type; 9.1 V	
	CR680	48-8239Z B03	silicon	
	CR681	48-8256C 18	silicon; Zener type; 9.1 V	
	CR682	48-8239Z B03	silicon	
	CR683	48-8256C 18	silicon; Zener type; 9.1 V	
	CR684	48-8239Z B03	silicon	
	CR685	48-8256C 18	silicon; Zener type; 9.1 V	
	CR686	48-8239Z B03	silicon	
	CR687	48-8256C 18	silicon; Zener type; 9.1 V	
	CR688	48-8239Z B03	silicon	
	CR689	48-8256C 18	silicon; Zener type; 9.1 V	
	CR690	48-8239Z B03	silicon	
	CR691	48-8256C 18	silicon; Zener type; 9.1 V	
	CR692	48-8239Z B03	silicon	
	CR693	48-8256C 18	silicon; Zener type; 9.1 V	
	CR694	48-8239Z B03	silicon	
	CR695	48-8256C 18	silicon; Zener type; 9.1 V	
	CR696	48-8239Z B03	silicon	
	CR697	48-8256C 18	silicon; Zener type; 9.1 V	
	CR698	48-8239Z B03	silicon	
	CR699	48-8256C 18	silicon; Zener type; 9.1 V	
	CR700	48-8239Z B03	silicon	
	CR701	48-8256C 18	silicon; Zener type; 9.1 V	
	CR702	48-8239Z B03	silicon	
	CR703	48-8256C 18	silicon; Zener type; 9.1 V	
	CR704	48-8239Z B03	silicon	
	CR705	48-8256C 18	silicon; Zener type; 9.1 V	
	CR1033	48-8239Z B03	silicon	

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	21-84494B48	180
	21-84494B47	140
	21-82372C04	05 uF +80-20%; 25 V
	21-84494B02	62
	21-82537B08	49 ±3%; 300 V
	8-82905J10	0.1 uF ±10%; 50 V
	21-84494B18	390
	21-84494B45	56
	21-84494B01	51
	8-82905G10	0.1 uF ±10%; 50 V
	21-84570B8	0.1 uF ±5%; 100 V
	21-84494B46	180
	21-84494B26	20
	21-84494B02	62
	21-84494B01	51
	8-82905J10	0.1 uF ±10%; 50 V
	21-84494B40	470 ±10%; 300 V
	21-8959 18	75
	21-852322	62
	23-83214C02	15 uF ±20%; 25 V
	21-8595 37	24
	21-8599 40	20
	21-8653 7B16	1000; 100 V
	21-84494B41	56
	21-84494B42	47
	21-84494B43	68
	21-84494B44	47
	21-84494B45	56
	21-84494B46	180
	21-84494B47	140
	21-82372C04	.05 uF +80-20%; 25 V



NOTES:

1. REFER TO THE TRANSMITTER AND RECEIVER ALIGNMENT PROCEDURES FOR THEIR CORRESPONDING TRANSMITTER AND RECEIVER CRYSTAL FREQUENCY CALCULATIONS.
2. DO NOT USE SLOW BLOW FUSE.
3. SEE PARTS LIST FOR COMPONENT VALUE.
4. UNLESS OTHERWISE STATED CAPACITOR VALUES ARE IN PICOFARADS, RESISTOR VALUES ARE IN OHMS, ALL RESISTORS ARE 1/4 W.
5. ALL DC VOLTAGES ARE MEASURED WITH A 20k OHM PER VOLT MULTIMETER, EXCEPT WHERE OTHERWISE NOTED. SUPPLY VOLTAGE DURING TRANSMIT - 13.8 V, SUPPLY VOLTAGE DURING RECEIVE 13.8 V.

USQ = RECEIVER UNSQUELCH
FSQ = RECEIVER FULLY SQUELCHED.

A. RECEIVER VOLTAGES ARE REFERENCED TO CHASSIS, EXCEPT AUDIO OUTPUT STAGE WHICH IS REFERENCED TO A-.
B. WHEN MEASURING TRANSMITTER VOLTAGES, USE A 33 uH CHOKE IN SERIES WITH THE MULTIMETER PROBE TO BLOCK RF VOLTAGES.
C. ALL EXCITER VOLTAGES FOR STAGES UP TO THE FIRST AMPLIFIER ARE REFERENCED TO CHASSIS.
D. ALL VOLTAGES IN THE FIRST AMPLIFIER, ALL POWER AMPLIFIER STAGES AND THE PROTECTION CIRCUIT 9.1 VOLTS ARE REFERENCED TO A-.
E "PL" VOLTAGES MARKED BY ASTERISKS ARE MEASURED IN THE TRANSMIT CONDITION.
F "(T)" DENOTES A (NOT CHASSIS GROUND)
G "(C)" DENOTES METAL CHASSIS GROUND.

6. VOLTAGES MEASURED WITH A MOTOROLA DC MULTIMETER (11 MEGOHMS/VOLT) AND HV PROBE OR EQUIVALENT.
7. TIME-OUT TIMER AND CONNECTIONS ARE OPTIONAL. Q350 AND R350 ARE NOT SUPPLIED UNLESS UNIT IS EQUIPPED WITH TIME-OUT TIMER. CR104 IS OMITTED IN TIME-OUT TIMER RADIOS.
8. TWO MALE PINS ARE PROVIDED IN THE EXCITER CIRCUIT FOR NETTING THE RECEIVER TO THE TRANSMITTER FREQUENCY. TO NET THE RECEIVER, REMOVE THE FEMALE CONNECTOR LEAD FROM THE NORMAL POSITION NEAR L106 AND CONNECT IT TO THE MALE PIN NEAR THE TRANSMITTER METERING SOCKET. THIS ACTUATES THE LOW LEVEL EXCITER STAGES AND THE RECEIVER OSCILLATOR CAN BE SET FOR A "0" DISCRIMINATOR READING.
9. IN A SINGLE-FREQUENCY RADIO, TRANSMITTER AND RECEIVER OSCILLATORS NO. 2, NO. 3 AND NO. 4 AND THE FREQUENCY SWITCHING WIRES ARE OMITTED. IN RECEIVER OSCILLATOR NO. 1, C140 AND C43 ARE DELETED AND A JUMPER IS SUBSTITUTED FOR C43. IN TRANSMITTER OSCILLATOR NO. 1, CR101 AND C116 ARE DELETED. A JUMPER IS SUBSTITUTED FOR C116.
10. BOLD NUMBERS INDICATE CORRESPONDING TIE POINTS.
11. S902 AND ASSOCIATED WIRING IS USED IN MULTI-FREQUENCY MODELS ONLY.
12. TRANSISTOR BASE DETAILS ARE SHOWN ON CORRESPONDING CIRCUIT BOARD DETAILS.
13. S902 AND ASSOCIATED WIRING IS USED IN "PL" MODELS ONLY.
14. COMPONENT REFERENCES OUTLINED BY A RECTANGLE INDICATE MARKING ON THE CHASSIS BOTTOM COVER OR THE CIRCUIT BOARD.
15. INDICATES FERRITE BEADS.

101. VOLTAGE CONDITION READINGS:
[ ] = MAXIMUM POWER OUTPUT, R106 FULLY CLOCKWISE.
( ) = POWER OUTPUT REDUCED AND POWER AMPLIFIER CIRCUIT PROTECTED TYPICAL VALUE.
102. EXCITER RF WAVEFORMS MEASURED WITH A TEKTRONIX "TYPE 454" OSCILLOSCOPE, 20C TO 150 MHz BANDWIDTH OR EQUIVALENT.
103. VOLTAGE VARIES FROM 2.12 V, 4 V IS TYPICAL.

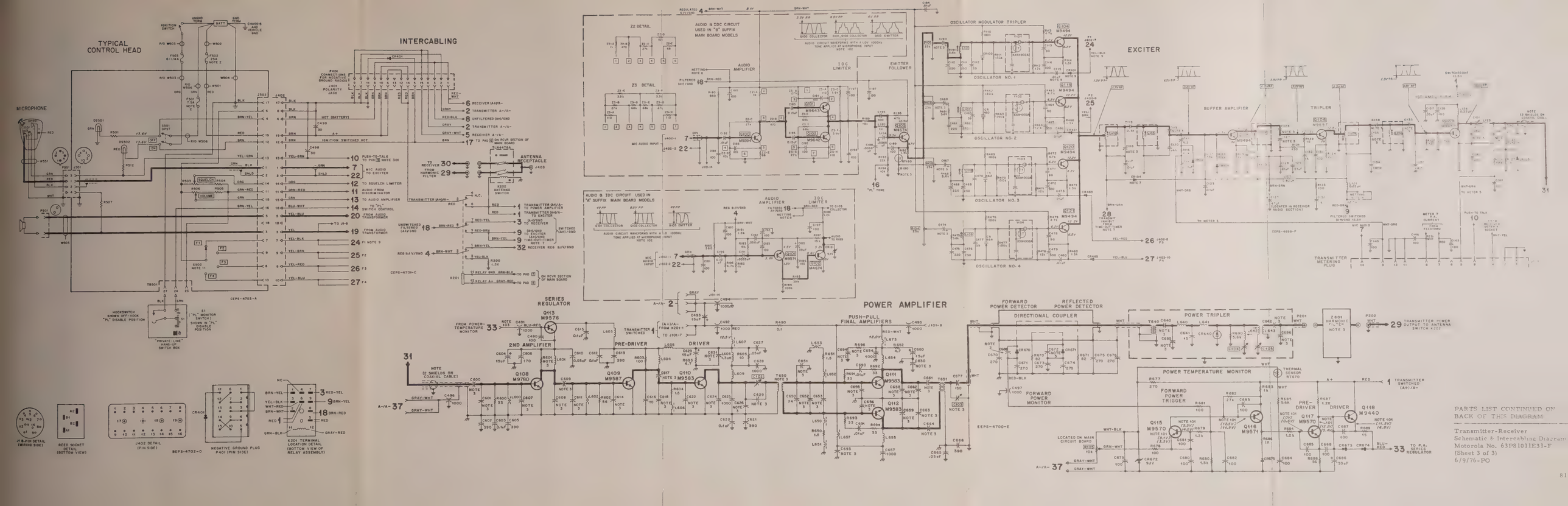
301. NUMBERED PINS ARE USED FOR CONNECTING "PL" SQUELCH CIRCUITRY. JUMPERS ARE REQUIRED WHERE INDICATED IN CARRIER SQUELCH OPERATION.
302. RF VOLTAGES MEASURED WITH MOTOROLA MODEL S1052B DC MULTIMETER USING S.1465A RF PROBE.
303. AUDIO OUTPUT STAGE VOLTAGES ARE REFERENCED TO A-.

701. DETERMINES TONE OUTPUT LEVEL - FACTORY DETERMINED.
702. THIS RADIO IS SHIPPED WITH JUMPER JU702 OUT AND JU703 IN. IN THIS MODE THE "PL" SQUELCH SENSITIVITY IS TIED TO THE CARRIER SQUELCH SENSITIVITY, THUS THE "PL" SQUELCH SENSITIVITY IS VARIABLE WITH SQUELCH CONTROL. IF DESIRED, THE RADIO CAN BE WIRED SO THE "PL" SQUELCH SENSITIVITY IS INDEPENDENT OF CARRIER SQUELCH CONTROL. TO ACCOMPLISH THIS, INSERT JUMPER JU702 AND REMOVE JUMPER JU703.

EPS-4705-B

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON FRONT OF THIS DIAGRAM

Transmitter-Receiver
Schematic & Intercabling Diagram
Motorola No. 63-81011E31-F
(Sheet 2 of 3)
6/9/76-PO


TYPICAL CONTROL HEAD
MICROPHONE
INTERCABLING
EXCITER
POWER AMPLIFIER
SERIES REGULATOR
PARTS LIST CONTINUED ON BACK OF THIS DIAGRAM.
Transmitter-Receiver
Schematic & Intercabling Diagram
Motorola No. 63P81011E31-F
(Sheet 3 of 3)
6/9/76-PO

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
L650 thru L653	76-83960B01	ferrite bead
L654, L655	24-84861B01	1-1/2 turns
L656	76-83960B01	ferrite bead
L670 thru L672		NOT USED
L673	76-83960B01	ferrite bead
L674		NOT USED
L751	24-84003A01	AF choke; 6 H
L752	24-84004A01	AF choke; 9 H; shielded
P201, 202	28-82331C01	CONNECTOR, plug
P401		male; coaxial, miniature type incl. 14-82317A05 BODY: 15 cont type 24-82335A01 TERMINAL, contact: male 19-81622E02 SHELL
Q1	48-869531	TRANSISTOR: (SEE NOTE I) field-effect, N-channel; type MD531
Q2	48-865534	N-P-N; type M9534
Q3, 8, 9,10	48-865434	N-P-N; type M9434
Q4	48-865404	P-N-P; type M4404
Q5	48-865456	N-P-N; type M9456
Q6, 7	48-869571	P-N-P; type M9571
Q100	48-865504	N-P-N; type M9504
Q101	48-869643	P-N-P; type M9643
Q102	48-869642	N-P-N; type M9642
Q103	48-834674	N-P-N; type M4674
Q104, 105	48-869494	N-P-N; type M9494
Q106	48-869657	N-P-N; type M9657; does not incl. 4-84910A01 INSULATOR, transistor mounting
Q107	48-869657	N-P-N; type M9657; does not incl. 4-84910A01 INSULATOR, transistor mounting, 2-4-84024B01 RADIATOR, transistor heat sink (cooling coils)
Q108	48-869780	N-P-N; type M9780
Q109	48-865587	N-P-N; type M9587
Q110 thru 112	48-865583	N-P-N; type M9583
Q113	48-869576	N-P-N; type M9576; does not incl. 4-84263B01 WASHER, insulating, shoulder type; 2 req'd NOT USED
Q114		
Q115	48-869570	N-P-N; type M9570
Q116	48-865571	P-N-P; type M9571
Q117	48-869570	N-P-N; type M9570
Q118	48-869440	N-P-N; type M9440
Q119 thru 121	48-869494	N-P-N; type M9494
Q301	48-865571	P-N-P; type M9571
Q302 thru 305	48-865576	N-P-N; type M9576
Q306	48-865571	P-N-P; type M9571
Q307 thru 309	48-865570	N-P-N; type M9570
Q340	48-869571	P-N-P; type M9571
Q341, 342	48-869570	N-P-N; type M9570
Q343, 344	48-869572	P-N-P; type M9572, does not incl. 4-84213A01 INSULATOR, transistor mounting
Q345	48-869571	P-N-P; type M9571
Q346	48-869617	P-N-P; type M9617
Q347	48-869571	P-N-P; type M9571
Q348	48-869257	P-N-P; type M9257
Q701	48-869125	N-P-N; type M9125
Q702	48-869571	P-N-P; type M9571
Q703	48-869328	P-N-P; type M9328
Q704	48-865327	P-N-P; type M9327
Q705	48-869197	N-P-N; type M9197
Q706	48-865570	N-P-N; type M9570
Q707	48-865571	P-N-P; type M9571
Q751 thru 753	48-869570	N-P-N; type M9570
Q756	48-865571	P-N-P; type M9571
Q757	48-869570	N-P-N; type M9570
R1	6-129753	RESISTOR, fixed: ±10%, 1/4 W unl. stated 150
R2	6-129618	10k ±5%
R3	6-128687	6.8k
R4	6-129231	3.3k
R5	6-127863	1.5k
R6	6-127802	1k
R7, 8	6-129233	47
R9	6-127807	33k
R10	6-129230	12k
R11	6-129804	2.2k
R12	6-129269	1.8k
R13	6-127807	33k
R14	6-127800	220
R15	6-129805	1k
R16	6-185B83	2.2k; 1/8 W
R17	6-131524	100
R18	6-128687	6.8k ±5%
R19	6-129669	4.7k ±5%
R20	6-129779	560 ±5%
R21	6-129775	330
R22	6-128688	2.7k
R23	6-129232	3.9k
R24	6-129145	82k
R25	6-128685	22k
R26	6-129232	3.9k
R27	6-127752	270
R28	6-127807	33k
R29	6-127669	4.7k ±5%
R30	6-129669	4.7k ±5%
R31 thru 33	6-129232	3.9k
R34	6-129804	2.2k ±5%
R35	6-129237	6.8k ±5%
R36	6-124C53	1.5k
R37	6-129232	3.9k
R38	6-129669	4.7k ±5%
R39	6-129669	4.7k ±5%
R40	6-129232	3.9k
R41	6-129669	4.7k ±5%
R42	6-129779	560 ±5%
R43	6-129775	330
R44	6-129804	2.2k ±5%
R45	6-129232	3.9k
R46	6-129232	3.9k
R47	6-127752	270
R48	6-127807	33k
R49	6-129669	4.7k ±5%
R50	6-129863	56
R101 thru 104	18-87083G16	var: 25k ±10%
R105	18-8308JG13	var: 10k ±10%
R110	6-124B04	180k ±5%
R111	6-128683	150k ±5%
R112	6-129687	12k ±5%
R113	6-129669	4.7k ±5%
R114	6-129681	1.5k ±5%
R116	6-129825	10k
R117	6-124926	33k ±5%
R118	6-129982	5.6k ±5%
R119	6-124A19	5% ±1%
R120	6-124A27	120 ±5%
R121	6-131276	150 ±5%
R122	6-124A05	15 ±5%
R123	6-131524	100 ±5%
R124	6-124A09	2.2 ±5%
R125	6-124A27	120 ±5%
R126	6-129279	68k ±5%
R127	6-129805	1k ±5%
R180	6-124C43	560
R181	6-129820	1.8k ±5%
R182	6-129805	1k ±5%
R183	6-131526	18k ±5%
R184	6-129226	100k
R185	6-128993	39k
R186	6-129682	180
R187	6-127805	15k
R188	6-129235	1.2k
R189	6-111526	18k ±5%
R190	6-129252	3.9k (single freq. models only) 6.8k (multi-freq. models)
R191	6-129413	5.6k
R192	6-127801	1.5k
R193	6-129267	22k ±5%
R194	6-123668	10k ±5%
R195	6-131527	47k ±5%
R196	6-129669	4.7k ±5%
R200	6-124C83	1.5k
R201	6-127801	1.5k
R202	6-127801	470
R203	6-129752	270
R204	6-129433	5.6k
R205	6-127802	1k
R206, 207	6-128687	6.8k
R208	6-127801	470
R209	6-127802	1k
R210	6-127801	1.5k
R211	6-129752	270
R212	6-129210	12k
R213	6-127800	220
R214	6-127802	1.5k
R215	6-129232	3.9k
R216	6-128599	680
R217	6-128904	18k
R218	6-129686	8.2k
R219	6-127800	220
R220	6-129211	3.3k
R221	6-129686	8.2k
R222	6-128599	680
R223	6-129232	3.9k
R224	6-127801	470
R225, 226	6-127801	1.5k
R227	6-127802	1k
R228	6-127807	33k
R229	6-129669	4.7k ±5%
R230	6-129669	4.7k ±5%
R231	6-129232	3.9k
R232	6-129232	3.9k
R233	6-129669	4.7k ±5%
R234	6-129669	4.7k ±5%
R235	6-129232	3.9k
R236	6-129232	3.9k
R237	6-129232	3.9k
R238	6-129232	3.9k
R239	6-129232	3.9k
R240	6-129232	3.9k
R241	6-129232	3.9k
R242	6-129232	3.9k
R243	6-129232	3.9k
R244	6-129232	3.9k
R245	6-129232	3.9k
R246	6-129232	3.9k
R247	6-129232	3.9k
R248	6-129232	3.9k
R249	6-129232	3.9k
R250	6-129232	3.9k
R251	6-129232	3.9k
R252	6-129232	3.9k
R253	6-129232	3.9k
R254	6-129232	3.9k
R255	6-129232	3.9k
R256	6-129232	3.9k
R257	6-129232	3.9k
R258	6-129232	3.9k
R259	6-129232	3.9k
R260	6-129232	3.9k
R261	6-129232	3.9k
R262	6-129232	3.9k
R263	6-129232	3.9k
R264	6-129232	3.9k
R265	6-129232	3.9k
R266	6-129232	3.9k
R267	6-129232	3.9k
R268	6-129232	3.9k
R269	6-129232	3.9k
R270	6-129232	3.9k
R271	6-129232	3.9k
R272	6-129232	3.9k
R273	6-129232	3.9k
R274	6-129232	3.9k
R275	6-129232	3.9k
R276	6-129232	3.9k
R277	6-129232	3.9k
R278	6-129232	3.9k
R279	6-129232	3.9k
R280	6-129232	3.9k
R281	6-129232	3.9k
R282	6-129232	3.9k
R283	6-129232	3.9k
R284	6-129232	3.9k
R285	6-129232	3.9k
R286	6-129232	3.9k
R287	6-129232	3.9k
R288	6-129232	3.9k
R289	6-129232	3.9k
R290	6-129232	3.9k
R291	6-129232	3.9k
R292	6-129232	3.9k
R293	6-129232	3.9k
R294	6-129232	3.9k
R295	6-129232	3.9k
R296	6-129232	3.9k
R297	6-129232	3.9k
R298	6-129232	3.9k
R299	6-129232	3.9k
R300	6-129232	3.9k
R301	6-129232	3.9k
R302	6-129232	3.9k
R303	6-129232	3.9k
R304	6-129232	3.9k
R305	6-129232	3.9k
R306	6-129232	3.9k
R307	6-129232	3.9k
R308	6-129232	3.9k
R309	6-129232	3.9k
R310	6-129232	3.9k
R311	6-129232	3.9k
R312	6-129232	3.9k
R313	6-129232	3.9k
R314	6-129232	3.9k
R315	6-129232	3.9k
R316	6-129232	3.9k
R317	6-129232	3.9k
R318	6-129232	3.9k
R319	6-129232	3.9k
R320	6-129232	3.9k
R321	6-129232	3.9k
R322	6-129232	3.9k
R323	6-129232	3.9k
R324	6-129232	3.9k
R325, 326	6-129232	3.9k
R327	6-129232	3.9k
R328	6-127800	220
R329	6-127802	1k
R330	6-129775	330
R331	6-129433	5.6k
R332	6-129818	820 ±5%
R333	6-129147	220k
R334	6-129431	5.6k
R335, 336	6-129886	27k ±5%
R337	6-128903	39k
R338	6-131858	270k ±5%
R339	6-129431	5.6k
R340	6-129144	68k
R341	6-128902	47k
R342	6-127802	1k
R343	6-129775	330
R345	6-129804	2.2k ±5%
R346	6-128688	2.7k
R347	6-129145	82k
R348	6-127804	4.7k
R349	6-129236	15k ±5%
R350	6-129804	2.2k ±5%
R351	6-129237	6.8k ±5%
R352	6-124C53	1.5k
R353	6-129237	6.8k ±5%
R354	6-129617	120
R355, 356	6-129755	10
R357	6-129473	330k ±5%
R358	6-129225	10k ±5%
R359	6-124B67	8.2 ±5%
R360	6-124A43	560 ±5%; 1/2 W
R361	17-82350A11	0.33 ±5%; 1 W
R362	6-131446	120k ±5%
R363	6-129887	12k ±5%
R364	6-129784	680 ±5%
R365	6-129982	8.2k ±5%
R366	6-128902	47k
R368	6-129232	3.9k
R369	6-127803	1.5k
R370, 371	6-129232	3.9k
R372, 377	6-129225	10k
R373	6-129232	3.9k
R374	6-128689	2.2k
R375	6-124A03	12 ±5%
R376	6-129753	100
R378	6-125C19	56; 1/2 W
R430	6-128687	6.8k ±5%
R431	6-129669	4.7k ±5%
R432	6-129779	560 ±5%
R433	6-128687	6.8k ±5%
R434	6-129669	4.7k ±5%
R435	6-129779	560 ±5%
R436	6-128687	6.8k ±5%
R437	6-129669	4.7k ±5%
R438	6-129779	560 ±5%
R461	6-129433	5.6k
R462	6-124B64	180k ±5%
R463	6-128683	150k ±5%
R464	6-129887	12k ±5%
R465	6-129669	4.7k ±5%
R466	6-129681	1.5k
R468	6-129433	5.6k
R469	6-124B04	180k ±5%
R470	6-128683	150k ±5%
R471	6-129887	12k ±5%
R472	6-129669	4.7k ±5%
R473	6-129681	1.5k
R475	6-129433	5.6k
R476	6-124B04	180k ±5%
R477	6-128683	150k ±5%
R478	6-129887	12k ±5%
R479	6-129669	4.7k ±5%
R480	6-129681	1.5k ±5%
R490	17-82586H05	0.1 ±5%; 5 W
R600	6-129756	33
R601, R601M	6-5660	180; 1/2 W
R601H	6-6270	220; 1/2 W
R602	6-5624	56; 1/2 W
R603	6-6326	100; 1/2 W
R604	17-890466	1.5; 1/2 W
R605	6-5621	10; 1/2 W
R650, 651	17-890466	1.5; 1/2 W
R652	6-124D61	4.7
R670, 671	6-6035	82 ±5%
R672 thru 676		NOT USED
R677	6-4000057	270 ±5%; 1/2 W
R678	6-131524	100 ±5%
R679	6-129735	1.2k
R680	6-127803	1.5k
R681	6-131524	100 ±5%
R682	6-129886	27k ±5%
R683	6-127802	1k
R684	6-129235	1.2k
R685	6-129982	5.6k ±5%
R686	6-129805	1k ±5%
R687	6-129708	1.2k ±5%
R688	6-124A19	5% ±1%
R689	6-131377	15
R690	6-3940	5.6k ±5%; 1/2 W
R691 thru 694	6-2036	33; 1/2 W
R695	6-124D61	4.7
R695L		NOT USED
R696M	6-124B55	2.7 ±5%
R696H		NOT USED
R701	6-129818	820 ±5%
R702	6-124A39	390 ±5%
R703	6-129862	150
R704	6-124A32	9.1k ±5%
R706	6-128687	6.8k ±5%
R707	6-129681	1.5k ±5%
R708	6-129984	680 ±5%
R709	6-129803	1k ±5%
R710	6-129752	270
R711	6-129820	1.8k
R712	6-118227	15; 1 W
R713	6-129777	39k ±5%
R714	6-128683	150k ±5%
R715	6-129886	27k ±5%
R716	6-129669	4.7k ±5%
R717	6-129984	680 ±5%
R718	6-129887	12k ±5%
R719	6-129149	470k ±5%
R720	6-131857	680k ±5%
R721	6-129707	2.7k ±5%
R722	6-129806	330 ±5%
R723	6-124A31	180 ±5%
R724	6-129982	5.6k ±5%
R725, 728	6-129279	68k
R729	6-128686	8.2k
R730	6-128683	150k ±5%
R731	6-129526	33k ±5%
R732	6-128987	120k
R733	6-124B12	390k ±5%
R734	6-129149	470k ±5%
R736	6-129188	820k ±5%
R737	6-129013	1 meg
R738	6-129526	33k ±5%
R739	6-128689	2.2k
R740	6-124A74	11k ±5%
R741	6-6373	150
R751	6-128689	2.2k
R752	6-128687	6.8k
R753, 754, 755	6-129225	10k
R756	6-131527	47k ±5%
R757	6-129709	470 ±5%
R758	6-129667	22k ±5%
R759	6-131527	47k ±5%
R760	6-129709	470 ±5%
R763	6-129667	22k ±5%
R764	6-129225	10k
R766	6-129431	180 ±5%
R767	6-124A97	100k ±5%
R768	6-129669	4.7k ±5%
R769	6-129779	560 ±5%
R770	6-129753	100
R771	6-129669	4.7k ±5%
R772	6-124A97	100k ±5%
R773	6-131527	47k ±5%
R774	6-129804	2.2k ±5%
R775	6-124A13	33 ±5%
R776	6-129225	10k
R777	6-128689	2.2k
R778	6-129669	4.7k ±5%
R779	6-129147	220k
R781	6-129669	4.7k ±5%
RT40, 180	6-82990E18	THERMISTOR: 190 ohms @25°C
RT340	6-82769A01	10 ohms @ 25°C
RT430, 431, 432,	6-82990E18	190 ohms @25°C
RT670	6-84499B02	211k @25°C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
RV140	6-858401	VARISTOR: 17.2k ohms ±10%; 8.8 V @25°C
T1	24-83879G07	TRANSFORMER, RF: coded VIO; incl. tuning core
T2	24-83879G03	coded ORG; incl. tuning core
T3	24-84946A01	TRANSFORMER, discrimination: 455 kHz; incl. 76-83156H07 CORE, tuning (pri); coded GRN, 76-83156H06 CORE, tuning (sec); coded YEL
T140	25-82058H01	TRANSFORMER, AF: pri: (tapped); res 670 ohms maximum (tap color coded) sec: (tapped); res 13 ohms maximum
T343	25-83492G02	pri: BRN, BLU w/lug center tap; res 0.5 ohm ±10%; sec: lug terminals; res 0.22 ohm maximum
T640	24-84665C01	pri: 2-1/2 turns sec: 1-1/4 turns
T650L, T650M	24-80906A90	TRANSFORMER, RF: coupling loop; consists of 2 wires within plastic tubing; loop length 2-1/2"
T650H	24-80906A91	coupling loop; consists of 2 wires within plastic tubing; loop length 2"
T651	25-84022B01	pri: 2 coils, 1-3/4 turns each sec: 4-1/4 turns
XQ343, XQ344	9-83817K01	SOCKET; transistor
XY1 thru 4, XY101 thru 104	1-80709B61	SOCKET, crystal: 4-contact
Y1 thru 4	K1018A	CRYSTAL UNIT, quartz: (SEE NOTE II) receiver 1st osc.; "plug-in" type; ±.0005% freq. stability
Y5	48-84863B01	receiver i-f bandpass filter: 11.7 MHz center frequency
Y6	G22	receiver 2nd osc.: 11.245 MHz (low-side injection)
	or G21	receiver 2nd osc.: 12.155 MHz (high-side injection)
Y101 thru 104	KXN1002A	transmitter osc.; "plug-in" type
Z1	TFN1000AS	FILTER, IF bandpass: 455 MHz center frequency
Z2	51-82142K04	RESISTOR NETWORK: 6-pin
Z3	51-82142K03	7-pin
Z401L	TFE6153A	FILTER, RF: low-pass: 450-470 MHz
Z401M	TFE6154A	470-494 MHz
Z401H	TFE6155A	494-512 MHz

NON-REFERENCED ITEMS

	26-84598A01	SHIELD, coil: used with L9, 10, 11, 12, L102 thru 106
	26-82451G01	SHIELD, discriminator: used with L312, L313, T3
	26-83875G03	SHIELD, coil: used with L6, T1
	26-82072G04	SHIELD, coil: used with L7, 8 and T2
	55-84914A01	BRACKET, "hinge"; (for heat sink radiator); 2 req'd
	26-84561B01	SHIELD: (for receiver multiplier)
	15-84491B01	COVER, bottom: incl. legend
	75-84962A01	SPACER, insulating: (used with bottom cover); (9 req'd)
	7-84691C01	BRACKET, grounding: for grounding coaxial shields on RF deck
	43-82721C03	BUSHING, screw retaining: "snap-in" type; 2 req'd
	3-135111	SCREW, tapping: 4-40 x 3/8" "Phillips" hex head; 2 req'd
	3-84048B01	SCREW, machine: 10-32 x 3/8" slotted hex head; "captive" type; 2 req'd
	42-82388C02	WASHER, screw retaining: ("C" washer); 2 req'd
	39-84680B01	SPRING, grounding contact: (used under heads of board mounting screw); 6 req'd
	2-84976A01	NUT, machine: round: slotted; for mounting Q108 through 112
	26-84020B01	RADIATOR, heat sink
	3-135031	SCREW, machine: 10-32 x 3/8" slotted hex head; 2 req'd
	4-7652	LOCKWASHER: No. 10 external; 2 req'd
	42-82134G01	"O" RING: neoprene; used as captivator for radiator holding screws; 2 req'd
	14-84859B01	INSULATOR, treated paper: (for PA circuit board mounting)
	14-83485C01	SOCKET, "Vibrasponder" resonant reed: 4-contact
	15-84345C01	PLATE, cover (Power Tripler)

NOTE:

I. Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

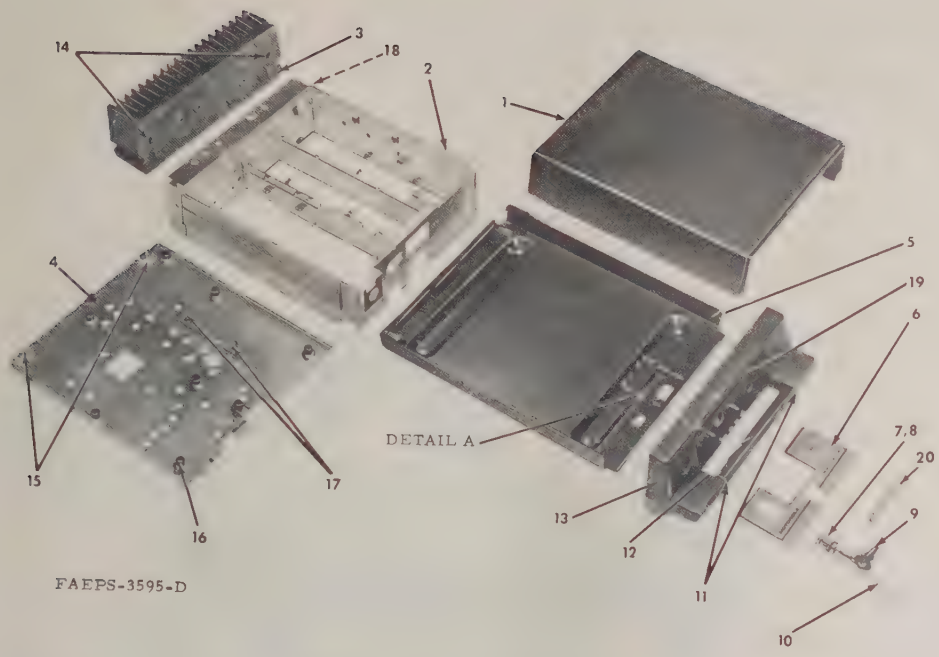
II. When ordering crystal units, specify carrier frequency, crystal frequency and crystal type number.

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C192	8-82905G16	CAE [illegible]
C193	23-82783B36	49 pF
C195	8-82905C07	6.8
C196	8-83813H37	1,000
C197	8-82987E07	9.12
C247, 346	8-82905G04	1000
C349	8-83293B02	6.2
C352	21-87326-9	82,000
C400, 402, 424	8-82905G07	4.7
CR1, 2		SEE NOTE II
CR3, 4		DIODE
Q1		TRANSISTOR
Q2, 3	48-869571	TRANSISTOR
Q340	48-865434	TRANSISTOR
Q341, 344	48-134594	TRANSISTOR
R1		RESISTOR
R2	6-124A03	15 ohms ±5%
R3, 4	6-124C09	82 ohms ±5%
R5, 6	6-124A05	18 ohms ±5%
R340		RESISTOR
R341	6-82769A01	10 ohms ±5%
XQ343, 344	9-82b73A01	SOCKET: 2-contact, pins not incl. 4-84263A01 WASHER, shoulder type
Z1, 2		RESISTOR NETWORK

NOTE I

The following are electrical components unique to the "A" Suffix Main Circuit Board Models only.

PL-1639-O



FAEPS-3595-D

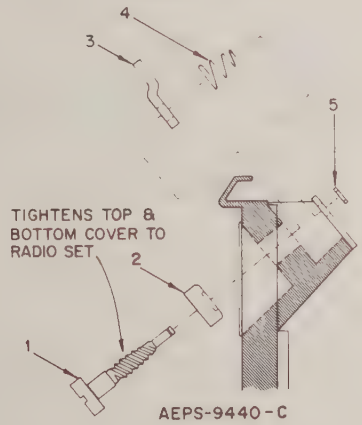
PARTS LIST

PL-1184-D

CODE	MOTOROLA PART NO.	DESCRIPTION
1	15E84920A03	COVER, housing; top
2	27E84441C03	CHASSIS
3	26D84020B01	RADIATOR, heatsink (450-470 MHz)
	or 1V80740B41	RADIATOR, heatsink (470-512 MHz)
4	15C84491B01	COVER, bottom
5	15E84920A01	HOUSING, base
6	13C84921A02	ESCUTCHEON
7	55-84912A03	LOCK ASSEMBLY (complete)
8	55-84912A01	BARREL AND NUT (P/O code 7)
8A	55-84912A02	CYLINDER AND KEY (P/O code 7) NOTE: Code 8A (Culinder and Key) must be removed using code item 10 (TOOL, lock-cylinder removal) before the front panel can be removed.
9	55-893872	KEY (P/O code 7)
10	66A84909B01	TOOL, for removal of lock
11	3S125457	SCREW, special; for handle
12	55C84909A01	HANDLE
13	1V80708B66	FRONT PANEL, does not incl. code 7, 11, 12
14	3S135031	SCREW, special
	42A82234G01	RETAINER
	4S115362	LOCKWASHER
15	3B84048B01	SCREW, special
	42A82388C02	RETAINER
	4S115362	LOCKWASHER
16	75A84962A01	BUMPER, rubber
17	43B82721C03	BUSHING, snap
	3S135111	SCREW, tapping: No. 4-40 x 3/8"
18	14C84656C01	RETAINER, tuning tool
19	3-138806	SCREW, machine: 8-32 x 5/16"
20	55-84530B01	BOLT, locking (nylon)

DETAIL A

(VIEWED WITH RADIO SET LYING ON ITS TOP)



AEPS-9440-C

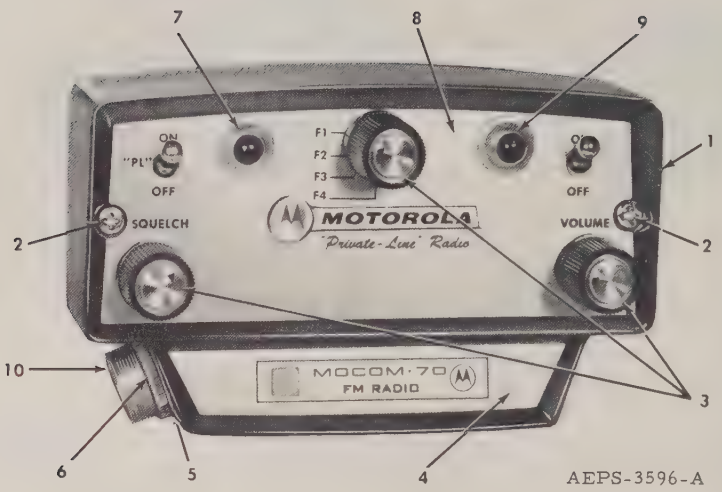
CODE	MOTOROLA PART NO.	DESCRIPTION

Front Panel Latching Kit PL-1943-O

*1	3B84460G01	SCREW, latching
2	4A84362B01	WASHER, cup
*3	45B84461G01	CAM, latching
4	41A822468	SPRING, Locking plate
5	42A82388C03	RING, retaining ("E" type)

* Codes 1 & 3 must be replaced together

450-470 MHz and 470-512 MHz "Mocom•70" FM Radio
Heat Sink and Housing Detail
Universal Model Radio Set
Motorola No. PEPS-4865-E
8/20/75-PO



PARTS LIST

PL-931-O

CODE	MOTOROLA PART NO.	DESCRIPTION
1	15D83576D07	HOUSING, dash-mount
	or15D83576D03	HOUSING, trunk-mount
2	3A82670A07	SCREW, special: dash-mount
	or3A82670A01	SCREW, special: trunk-mount
3	36B82629H02	KNOB, control; dash-mount
	or36K858652	KNOB, control; trunk-mount
4	33B83646D07	NAMEPLATE (dimmer)
	or33C83646D08	NAMEPLATE (non-dimmer)
5	4S7699	WASHER, lock; 13/16" INT.
6	2A482070	NUT, ring
7	61B83678D01	LENS, indicator light (RED)
8	13D857971	ESCUTCHEON, 1 freq. (carrier squelch)
	or13K857972	ESCUTCHEON, 2 freq. (carrier squelch)
	or13D82286C23	ESCUTCHEON, 4 freq. (carrier squelch)
	or13K857975	ESCUTCHEON, 1 freq. ("Private-Line")
	or13K857976	ESCUTCHEON, 2 freq. ("Private-Line")
	or13D82286C22	ESCUTCHEON, 4 freq. ("Private-Line")
9	61B83678D02	LENS, indicator light (GREEN)
10	9K830418	CONNECTOR, receptacle: female: 4 contact

Control Head Escutcheon and Housing Detail
Motorola No. PEPS-3599-B
8/20/75-PO

REDUCTION OF INTERFERING NOISE IN MOBILE OPERATION

1. INTRODUCTION

Noise generated by the electrical system of the vehicle, as well as local ambient noise, might interfere with normal operation of two-way mobile radios. To overcome these interferences, various noise reduction procedures are required. These requirements vary from one vehicle to another, depending on system frequency, vehicle type and required coverage area. If the operating area is sufficiently small (received signal levels always high), less noise reduction is required. Conversely, for maximum range coverage and operation into weak signal areas, noise reduction becomes very important.

Before attempting any noise reduction procedures, determine the noise source. Then, follow a systematic method of elimination until the interference is removed or appreciably reduced.

2. NOISE REDUCTION

a. Noise Reduction Kits

The Model TLN8845A Noise Reduction Kit is available for all vehicles equipped with two-way radios. For vehicles with generators or with severe noise problems, Model TLN6252A Noise Reduction Kit is recommended. See Figures 1 and 2.

b. General Information

Impulse noise is most noticeable in installations of narrow bandwidth receivers because of ringing associated with the steep-sided selectivity characteristics. This equipment has been designed to minimize the ringing effect of impulse noise as much as possible.

MOTOROLA INC. Communications Division
SERVICE PUBLICATIONS 1301 E. ALGONQUIN ROAD SCHAUMBURG, ILLINOIS 60172

TLN6252A NOISE REDUCTION KIT

Reference Number	Quantity	Motorola Part Number	Description
1	3	1V839913	Lead & Lug Assembly
2	1	1V80700A88	Lead & Lug Assembly
3	1	8C82571B02	Capacitor, Coaxial (.1 uF - 100 V)
4	3	8C82571B01	Capacitor, Coaxial (.5 uF - 100 V)
5	1	1V80700A89	Generator Field Suppressor Assembly
6	1	30A502396	Ignition Coil Suppressor Cable
7		1V80700A91	Hood Wipers and Mounting Kit Hardware

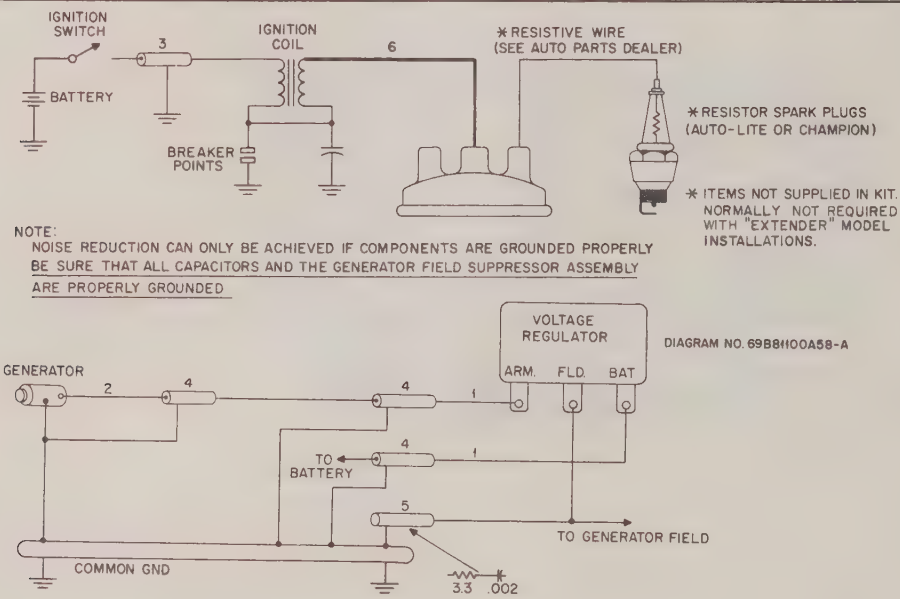


Figure 1. Typical Noise Reduction Detail Using TLN6252A Noise Reduction Kit

TLN8845A NOISE REDUCTION KIT

Quantity	Motorola Part Number	Description
1	1V839913	Lead & Lug Assembly
1	8C82571B02	Capacitor, Coaxial (.1 uF, 100 V)
1	30A502396	Ignition Coil Suppressor Cable
1	1V80782A52	Hood Wipers and Mounting Hardware Kit

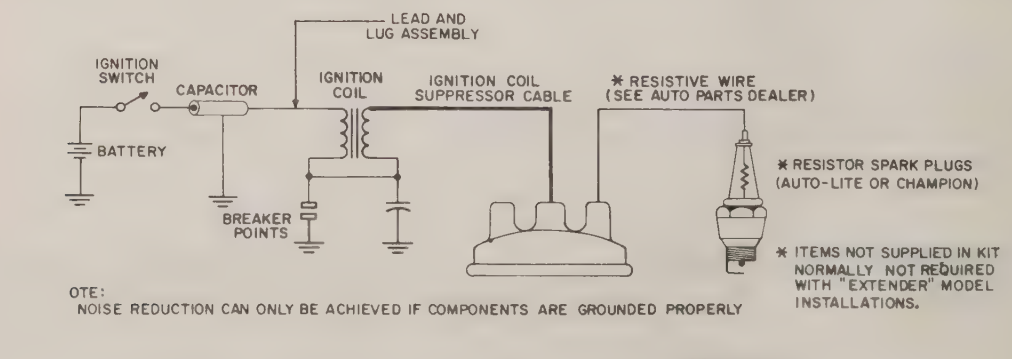

LEAD AND LUG ASSEMBLY
IGNITION SWITCH
CAPACITOR
IGNITION COIL
IGNITION COIL SUPPRESSOR CABLE
* RESISTIVE WIRE (SEE AUTO PARTS DEALER)
BATTERY
BREAKER POINTS
*RESISTOR SPARK PLUGS (AUTO-LITE OR CHAMPION)
* ITEMS NOT SUPPLIED IN KIT NORMALLY NOT REQUIRED WITH "EXTENDER" MODEL INSTALLATIONS.
OTE:
NOISE REDUCTION CAN ONLY BE ACHIEVED IF COMPONENTS ARE GROUNDED PROPERLY
69B81116A62-B

Figure 2. Typical Noise Reduction Detail Using TLN8845A Noise Reduction Kit

The useful range of radio receivers can be seriously affected by noise interference which prevents the reception of a clear, easily-understandable signal. A certain amount of noise interference may be tolerated when operating in a strong signal area. However, in weak signal areas such as fringe area operation, serious noise interference can cause a complete failure in reception.

c. Noise Sources

The source of noise can generally be determined by its sound in the speaker. For best results in locating noise, the unit should be receiving a weak signal which produces not less than 10 dB nor more than 30 dB noise quieting.

Noise interference is usually traced to one of the following sources:

(1) Ignition Noise

An automobile electrical system provides the primary source of electrical interference to radio communications in mobile installations. Radio interference can be generated in the spark plugs, distributor contacts, generator armature, voltage regulator, electrical gauges, wheel static and any part of the car where friction may exist due to intermittent contact between any two members of the car's mechanical structure.

In a mobile installation, the prime source of electrical interference with radio communications is in most cases the result of a spark discharge or arc created in the electrical system. Whenever a spark discharge takes place through air, high frequency oscillations are generated in a range of frequencies from a few kilohertz to hundreds of megahertz. These oscillations are generally radiated and therefore received through the antenna. However, they may also be induced in associated wiring and transferred to other electrical wiring in the system including that of the radio installation.

Suppressing all arcing that can develop in the electrical system may pose a difficult problem. For example, in an 8 cylinder engine operated at 2000 rpm, arcing in the engine system can be at the rate of 8,000 spaks per minute or 133 per second. These arcs, after being extended because of ringing, can create a blanket of noise which will block out weak signals at the radio receiver.

(2) Impulse noise interference generated by the vehicle electrical system.

This type of interference is generated by commutator and brush action, vibration of electrical contacts and electrical arcing or sparking. This broad-band interference may be propagated via space radiation.

The impulse noise enters the receiver through the antenna and serious interference in the form of tuned circuit "ringing" results even though the impulse may be very brief. "Ringing" may be defined as the shock excitation of a tuned circuit caused by an impulse which extends the duration of the impulse. It is the "ringing", caused by the impulse rather than the impulse itself, which is troublesome.

(3) Noise produced by flourescent lights, electric motors, electric fences, induction from power lines and similar sources.

This type of interference is generally AM in nature, excluding capture effect. Normally, if signal strength is adequate, all such noise is removed from a received carrier by effective limiting action. Also, a vehicle is able to move out of a high noise level area if this type of noise interferes with radio reception. Thus, such conditions may be tolerated.

NOTE

Thermal agitation noise and noise produced in the receiver have been taken into consideration in the original design of the equipment. Any well designed mobile radio unit will not present any serious problems in this respect.

d. The Ignition System

In order to effectively reduce ignition interference in a car, it is well to understand the operation of an automobile ignition system.

Ignition is necessary in a gasoline engine to ignite the gasoline vapor and the air mixture in its cylinders. The system is made up of the battery, distributor, breaker points, coil, condenser and spark plugs. The battery is the only electrical source of power in an automobile, so the low battery voltage must be stepped up to the high voltage necessary to arc across the spark plug electrodes. This arc ignites the gas mixture.

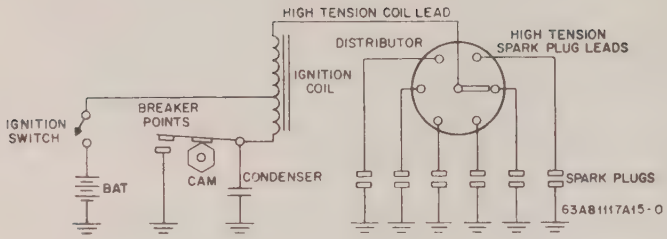


Figure 3.

Typical Vehicular Ignition System,

Schematic Diagram

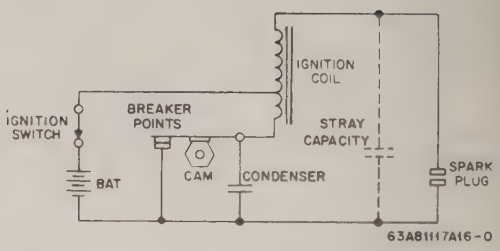


Figure 4.

Typical Vehicular Ignition System,

Simplified Schematic Diagram

In the conventional ignition system (Figures 3 and 4) a mechanical circuit breaker (points in the distributor) opens the primary circuit of the ignition coil. By transformer action in the coil, high voltage is developed at the coil secondary. This high voltage is synchronized and applied to each spark plug by the distributor.

The battery is connected to the primary winding of the coil through the ignition switch. The primary circuit is returned to the battery through the breaker points, which are bypassed by the condenser. The points are normally closed. As the cam shaft is rotated by the engine, its lobes or corners open and close the points in proper synchronization with each cylinder.

With the ignition switch on and the breaker points closed, coil primary current builds up at a rate determined by coil inductance.

When the breaker points open, primary current decreases and by self-induction, an emf is induced in the primary which is many times greater than the battery voltage. The high voltage induced in the coil secondary causes a spark across the spark plug gap for a short interval of time. When the breaker points open, the condenser reduces arcing of the points.

The secondary circuit of the ignition coil, including the spark gap, is much like a spark transmitter used in the early days of radio. It is the main source of ignition interference. All that is needed to simulate the spark transmitter is an inductance and capacitance in series with the spark gap. The lead inductance and stray capacitance provides a tuned circuit. Because the discharge of the circuit is through a low resistance (ionized spark gap), the circuit tends to oscillate. The frequency and amplitude of oscillation that is developed vary as current changes in the spark gap.

e. Noise Reduction Technique

It has long been known by ignition engineers that the addition of a series resistance adjacent to a spark discharge will damp out the troublesome oscillation which causes interference. The type of spark plug suppression used in noise reduction should always be in accordance with the recommendations of the car manufacturer, i.e., if spark plugs are to be replaced with built-in suppressor types, they should be in the proper heat ranges and thread sizes for the particular engine. In each ignition system there is a maximum amount of resistance that may be connected between the distributor and a spark plug. If resistance-type ignition wire is used, the length of each wire must be limited so its resistance does not exceed the allowable maximum. In addition to spark plug suppressors or resistance wire, an economical basic kit of noise reduction items can consist of the following: special coaxial capacitors, combinations of resistor and capacitor assemblies and hood wiper springs.

NOTE

In all cases where coaxial capacitors are mentioned, they should not be substituted by standard bypass capacitors; the standard bypass displays a resonance effect at about 2 MHz. The coaxial type is non-inductive and has high attenuation, up into the uhf region.

The importance of such noise reduction items is greatly increased by their application at the right terminal points in the car's electrical system. Following is an outline of the important points to be considered and a step by step procedure for ignition noise reduction.

NOTE

Noise reduction can only be achieved if components are properly grounded. BE SURE THAT ALL CAPACITORS AND THE GENERATOR FIELD SUPPRESSOR ASSEMBLY ARE PROPERLY GROUNDED.

On some vehicles, standard bypass capacitors might have been installed at locations referred to in these instructions. Where the instructions call for coaxial capacitors, remove the standard bypass capacitor and install the coaxial type.

In the development of a noise reduction kit, it was not necessary to include resistance cable or suppressor resistors in the wiring harness. Such items are generally found as a standard part of present day motor vehicles. However, the omission of such items from a basic noise kit does not imply that these items are nonessential to noise reduction. Spark plug noise reduction is one of the most important points to be covered in the elimination of radio interference in any vehicle.

(1) Generator Interference (Generator Equipped Vehicles Only)

The generator is a source of electrical interference frequently blamed on the ignition system. Electrical current passing between the brushes and commutator in the generator creates many small arcs as the armature rotates. Generator noise is characterized by a high pitched "whine" that varies with engine speed. A .5 uF coaxial capacitor should be placed in series with the generator armature to reduce interference.

NOTE

If the vehicle is supplied with an alternator, the capacitor is not necessary.

(2) Voltage Regulator Interference

The modern voltage regulator is a precise mechanism containing three separate control systems operating with breaker contacts. Vibrating breaker contacts cause arcing which may result in annoying interference. This interference is usually in the form of erratic popping in the receiver which changes only slightly in frequency with increase in engine speed.

To reduce voltage regulator noise, two .5 uF coaxial capacitors and a resistor-capacitor assembly are used.

CAUTION

Disconnect the battery ground terminal before attempting to connect components to the battery terminal of the voltage regulator.

(3) Ignition Coil Interference

A .1 uF coaxial capacitor should be placed at the BAT side of the ignition coil to eliminate impulses from the low voltage leads. (Refer to Figures 1 and 2.)

(4) Distributor Interference

Sparking in the distributor itself is a source of radio interference. As the rotor rotates in the cap, sparking occurs between the rotor and the distributor cap inserts. An effective way to reduce this interference is to use resistance-type ignition wire to connect the distributor cap to the ignition coil.

(5) Battery Connection

Connecting the radio set primary power lead directly to the battery instead of the starter relay can help to keep noise off the "A" lead. The battery acts as a large capacitor (about 1 farad for 50 amp capacity batteries), and serves as a very effective bypass. The battery ground return should be bonded to the frame. To minimize the possibility of inducing undesirable parallel ground currents, utilize the vehicle frame as a common ground point whenever it is practical to do so.

(6) Hood Wipers

Ground returns for the electrical circuits are provided through the body and frame of the automobile. Differences in conductivity, inadequate bonds between adjacent conductors, and unequal current distributions result in potential differences throughout the vehicle. The miniature arcs thus created can be avoided by eliminating the potential differences. Effective use of copper bonding braid and brass contact wipers as hood bonds will minimize interference from this source.

(7) Ignition System Interference

Ignition Noise can often be reduced by proper engine maintenance and tune-up. The following points should be considered if the noise interference from the ignition system is severe.

(a) The distributor points and condenser should be in good condition.

(b) Ignition timing should be properly adjusted.

(c) The distributor cap and rotor should be replaced at least every 30,000 miles.

(d) Spark plug wires should make good contact at each end and should be routed as far as possible from low voltage leads.

(e) Many late-model automobiles are equipped with a shield over the distributor points. Check to see that this shield is in place properly and is securely attached.

f. Additional Noise Reduction Techniques

In some radio installations, it might be necessary to obtain maximum noise reduction. In such installations, the following possible sources of noise interference should be explored and the following appropriate remedy applied.

(1) Ammeter to battery lead. (Bypass with .5 uF capacitor. Motorola part #8A821889.)

(2) Gauges, oil signal, gasoline and temperature. (Bypass with .5 uF capacitor. Motorola part #8A821889.)

(3) Ignition switch. (Bypass with .5 uF capacitor. Motorola part #8A821889.)

(4) Headlight, tail light, or dome light leads. (Bypass with .5 uF capacitor. Motorola part #8A821889.)

(5) Accessory wiring, electrical windshield wipers, heater motor, window openers and others. (Bypass with .5 uF capacitors. Motorola part #8A821889.)

(6) Wheel static. (Use wheel static collector rings on both front wheels. Motorola part numbers 1K534254 Regular Type; 1K563173 Small Type.)

(7) Acute cases of generator noise. (Install a .5 uF capacitor in series with the armature lead. Motorola part #8A821889.)

(8) For severe cases of ignition interference, Hallett Ignition Shielding Kits are available through Motorola on separate order. These special shielded harnesses, available for most automobile and truck engines, provide improved communication in fringe areas and essentially waterproof the ignition system. Supply the following information when ordering Hallett Ignition Shielding Kits.

(a) Make and year of vehicle.

(b) Auto or truck and number of cylinders.

(c) Engine cubic inch displacement.

(d) Type of ignition system: Auto-Lite, Chrysler, etc.

NOTE

Fire truck engine shielding requires more detailed information to assist in supplying the proper kit. Write first for the special "fire truck shielding form" from your nearest Motorola Parts Depot.

(9) A generator-regulator shield is available to further reduce generator and regulator noise. It is not required on alternator-equipped vehicles. Follow the same ordering procedure when requesting this item.

g. Conclusion

The level to which ignition noise interference will need to be reduced will depend on the environmental conditions of operation of the radio system. The factors involved are the strength of the received carrier at various points within range of the fixed station, and the clarity of signals at the fringe areas. However, in most cases ignition noise interference can be substantially reduced, resulting in excellent performance of the radio equipment under most operating conditions.

The reduction of ignition noise interference, in many cases, is essential to good system performance. Therefore, it must be given full consideration in the initial installation of the radio

equipment. The components required to successfully reduce ignition noise interference may well prove to be a necessary part of the communications system. Indeed, no mobile radio installation is complete until the remedy for bothersome ignition noise interference has been successfully applied.

Certain noise sources may be isolated to some extent, through consideration of conditions. When the vehicle is standing still with the ignition switch off, any noise heard will probably be external to the vehicle. Static discharge noise will be added when the vehicle is moving. If the vehicle is coasting in gear but with the ignition switch off, generator noise, if present, will be added to the others. Noise produced by inadequate bonding will be most noticeable when maximum current is being drawn from the battery, and may be increased when the vehicle is in motion. Care should be used to be sure that noise tests are made both with and without weak signals.

One effective way to find the hottest sources of interference is to use a pickup loop about one inch in diameter, connected to a radio receiver or oscilloscope powered from a source separate from the vehicle ignition system. Use the pickup loop as a search probe. Be sure the loop has sufficient insulation to prevent the input of the test equipment from coming into direct contact with high voltage points in the vehicle ignition system. This pickup loop technique is also a good way to determine the effectiveness of a particular noise reduction method.

It is impossible to given an exact procedure to counteract noise in all cases; too many variables exist. With an understanding of some of the sources of noise, an intelligent approach will often save considerable time. Ignition noise reduction can add to both operational efficiency and operator satisfaction.

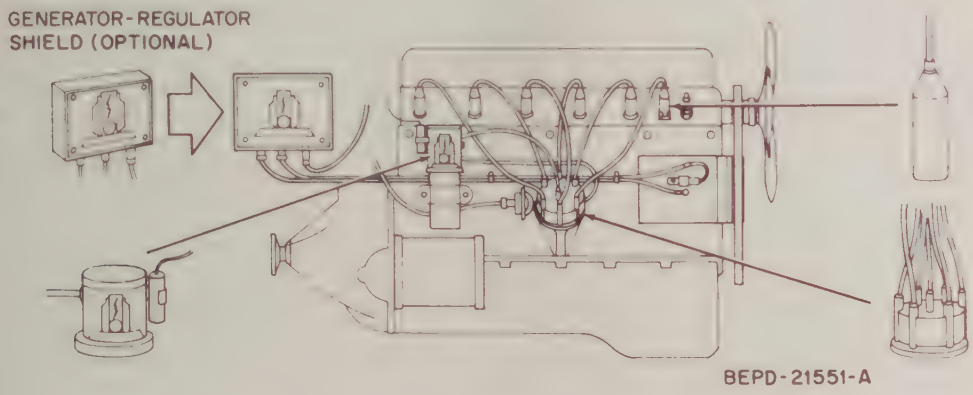


Figure 5. Typical Ignition Shielding Kit

NOISE IDENTIFICATION AND REDUCTION CHART

Characteristics of Noise at Speaker	Source of Noise	How to Check Source of Noise	How to Reduce Noise
Identified as popping sound	Ignition	Noise varies in frequency with engine speed and will disappear when ignition is switched off.	1. Check to be sure: (a) Distributor breaker points and distributor cap are in good condition. (b) Ignition capacitor is in good condition. (c) All ignition system connections are free of corrosion & making good contact. (d) There is dc continuity in high voltage leads. (e) There are sufficiently high spark plug breakdown voltages. (f) Spark plug electrodes are properly spaced and in good condition. 2. Bond each corner of the motor block to chassis ground using a heavy copper grounding braid. 3. Damp the high voltage by installing a resistor suppressor in the distributor rotor lead, or suppressors in the ignition cables or on top of the spark plugs. 4. Install resistor spark plugs or resistance ignition cables.
Identified as a high pitched whine	Generator/ Alternator	Noise varies with engine speed and will persist if ignition is switched off while engine is running at a moderate speed.	Install a .5 uF coaxial capacitor at the generator in series with the armature lead.
Identified as a raspy sound	Voltage Regulator	Look for arcing voltage regulator contacts	Install .5 uF coaxial capacitors, Motorola Part No. 8A821889 at the battery (BAT.) terminal in series with the battery lead and at the generator (ARM) terminal in series with the armature lead.

NOISE IDENTIFICATION AND REDUCTION CHART (Cont'd)

Characteristics of Noise at Speaker	Source of Noise	How to Check Source of Noise	How to Reduce Noise
Identified as raspy sound (continued)			Install RC Filter (1V80700A89) composed of a 3.3 Ohm resistor in series with a .002 uF capacitor (Maximum allowable capacity) in series with the field (F) terminal of the voltage regulator to a common ground.
Identified as a popping sound	Heater and Air Conditioning Fan Motors	With engine off, turn fan motors on and check for noise.	Install .5 uF coaxial capacitor at the motor in series with the battery lead.
Identified as a hissing or crackling sound	Gauges	Noise may be detected by jarring the individual gauges while the ignition is on.	Install .5 uF bypass capacitors where needed. (Motorola part #8A821889)
Identified as a low-pitch clicking	Oil Sender	Noise rate varies with oil pressure and stabilizes at point of maximum oil pressure.	Install .5 uF bypass capacitor (Motorola Part #8A821889) from gauge lead terminal on oil sender to chassis ground.
Identified as an irregular popping	Wheel Static	Noise disappears when brakes are lightly applied.	Install suitable grounding brushes or springs such as front wheel static eliminators (Motorola Part #1K534254 regular type, 1K563174 small type).
Identified as a more regular or sharper popping sound.	Tire Static	Noise becomes much worse at 30-50 mph.	Use anti-static power in tires with innerttube.

ANTI-SKID BRAKING PRECAUTIONS

1. GENERAL

The following recommended transmitter installation and test procedures are suggested for vehicles with electronic anti-skid braking systems.

2. INSTALLATION SUGGESTIONS

Locate the braking modulator box in the vehicle. The braking modulator box is located in the trunk in Chrysler Corporation cars and either in the trunk or under the dash in General Motors and Ford Corporation automobiles. A service manual may be helpful to aid in the location of the braking modulator box. Perform transmitter installation in accordance with the following recommended procedures:

a. If the braking modulator box is mounted on the right side of the vehicle, mount the transmitter on the left side of the trunk to give it as much space as possible between the braking modulator box and the transmitter. If the braking modulator box is mounted on the left side, reverse the procedure.

b. Use the shortest practical length of Motorola coaxial cable.

c. The antenna should be mounted on the opposite side of the car trunk from the braking modulator box.

d. Route all cables along the center or on the opposite side of the vehicle from the braking modulator box.

e. Do not operate the transmitter while the vehicle is in motion with the trunk lid open.

3. TEST PROCEDURE

This test is divided to cover several different types of interference. Disturbance of the electronic anti-skid device can usually be detected in several different ways concerning the vehicle's braking system, i.e., by the lights, any irregular audible sounds, any change in the performance of the braking system itself, etc.

During checks a. thru f., however, none of the above conditions should be observed if the radio set is properly installed.

a. With car stationary (gear selector in PARK) and the engine running at a fast idle, key (turn the carrier on and off) the transmitter with and without modulation with your foot off of the brake pedal.

b. Repeat the preceding with your foot on the brake pedal.

c. When making this test, while the car is stationary, allow at least 2 car lengths and possibly even more of clear area in front of the vehicle. With your foot on the brake with just enough pressure to keep the vehicle from moving, place the car in a forward gear with the engine at a fast idle, then key the transmitter with and without modulation.

WARNING

Disruption of the anti-skid braking system may cause the vehicle to move forward in addition to the lights and audible sounds mentioned above.

d. Driving at a moderate speed (15-25 mph) with your foot off of the brake pedal, have

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